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[Founded in 1849 as the "Journal of Gas Lighting."]

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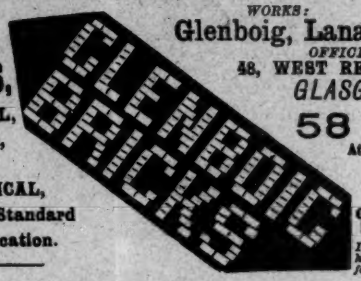

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VOL. CLXIV., No. 3160.] WEDNESDAY, DECEMBER 5, 1923. [75TH YEAR.

EDITORIAL NOTES.

Policy and Efficiency in the Sales Department.

OPINIONS and actions in the gas supply industry have vastly changed. There was a time when very little notice was taken at the meetings of gas engineers of the vitally important department of their undertakings concerned with the sales of gas—that huge territory lying beyond the service-pipe and meter, where decisions are made, on various grounds, as to which agent to employ for light, heat, and power. But now the chief officers of the gas sales department—these being the men who know how much conditions have altered through the expansion of the applications of gas and the intensified competition of electricity and coal—are welcomed to the meetings of engineers and managers to expound their views as to the right principles and methods of carrying on the sales work of a gas undertaking, and to have these matters discussed by the chiefs. Conference of the kind must result in promoting managerial efficiency; and no broad-minded engineer or manager will resent this statement. The work of a gas undertaking has become so large and diversified, that there is more devolution of duties than aforetimes; and the greater this devolution, the greater becomes the responsibility of the management in respect of supervision and the acquisition of knowledge of what is transpiring in every branch of the work and business. The more devolution there is of duty, the more it is necessary to cultivate the co-operative idea between management and departmental heads and staff in order to attain the maximum managerial efficiency. That co-operative idea has been fostered in many places. We see its extension in the interest that a large number of engineers take in the Salesmen's Circles; and we have had instances of the chiefs of sales staffs being welcomed and invited to present material for discussion at the meetings of gas engineers and managers. There is no part of the work of management that in the present day requires more study than this. We may point to the expansion of the business of the industry and to record gas sales in proof that things are going on very well; but there is the outstanding fact that competition is being intensified in every direction, and that inefficiency at the sales end will first cause dissatisfaction, then a deterioration of the rate of increase, and finally bring about an absolute decrease of otherwise potential business—individually and in the aggregate. That is the course of things that is favoured by neglecting vital parts of the business.

At their meeting last week, the Southern Association of Gas Engineers and Managers had a paper from Mr. S. B. Chandler, of the Tottenham District Light, Heat, and Power Company, which is admittedly one of the most progressive of suburban concerns in respect of its sales department. The paper was an excellent one, and covered much ground in respect of the general principles which, in the view of the author, should be adopted in connection with the selling of gas. There is very little disagreement as to the principles he submits being valid and right. Where there is disagreement is in their effective application, or negligence in applying them, or in the details of methods adopted in association with them. Policy, methods, and efficiency are three things which should go together; and, to cover neglect of these things on the other side of the consumers' meters, too much stress should not be laid on the price of the therm. Mr. Chandler states in the forepart of his paper that, to make town gas the one and only fuel, the main point now to be considered by the industry is the cheapening of the therm. Then the rest of the paper is devoted to showing that there is an equally important "main" consideration for the industry to-day, and that is the work which must be done among actual consumers and possible ones. In their midst, the business of the industry begins and grows where right conditions prevail; and among them it would decline, and that rapidly, if a better and more economical way of obtaining the same services were found. The price of the therm, there can be no disputing, is important to the sales department. But look at the table which Mr. Chandler gives based on the gas therm at 10d., and examine the rates per unit at which electricity must be sold to compete on equal price terms! Turning from our observation of those figures to the text of the paper, we are soon persuaded that, while doing all possible to reduce the price of the therm, the main thing that is wanted in the industry to-day is a stronger concentration (speaking generally) upon the character of the work which is required among the consumers, particularly in respect of lighting. The largest consumption in our houses to-day is for cooking and heating, at—be it marked—the same price per therm as for lighting. The desire, of course, is to see the heating consumption increase; and price will undoubtedly tell in that connection. But the point we wish to make is that, though the consumption of gas for lighting is relatively small to that for heating and cooking, it is from the lighting section that most business has been removed by competition; and yet it is for lighting that the electrical competitor charges the highest price per unit. In a communication that Mr. W. J. Sandeman, of Croydon, has sent for publication bearing upon Mr. Chandler's paper [see end of discussion], he tells us that he has taken out the average consumption of gas on all the housing estates in the Croydon district; and he finds that on those where gas is used for lighting and cooking, the average consumption is about 34,000 c.ft. per annum, compared with 29,000 c.ft. per house where electricity is used for lighting and gas for cooking—a difference of 5000 c.ft. per house per annum. That is a difference per house that cannot be ignored; multiplied by the number of houses, it makes a substantial sum. There we have illustration of the fact that while the price per therm obtains such a good patronage per house for cooking and heating, a very substantial percentage of the otherwise possible consumption is taken away by electricity. This is ground we have to recover if possible, or, to the utmost of our power, prevent its extension.

In the lighting territory the keenest struggle is taking place; and contest for the cooking load comes next, though that is far less vulnerable for several well-known reasons. But to meet the conditions of to-day in the sales part of a gas undertaking's work, which part is the real seat of prosperity, Mr. Chandler, as a responsible officer in an important sales department, pleads for thorough organization of the work throughout the industry—in respect of policy, methods, and men. A broad policy is necessary; and if economy and good work are to be secured, there must be efficiency in methods, in supervision, and in the men of all grades engaged on the work. These things, of course, cannot be standardized. Different local conditions demand different planning and treatment.

Gas has many advantages. Throughout its applications, it can show economy and rapidity of operation compared with its chief competitor; and the therm has supplied an

argument in the comparison which every day will make more effective and more powerful. The electricians do not like comparisons on the thermal basis. Gas men do; and the therm has become established just when the electricity industry was beginning to show more fervour and anxiety to raise the daylight part of their output curve by obtaining all-the-year-round cooking custom. The managers and salesmen of gas undertakings should note that electrical men believe the line of least resistance for securing a cooking load is to be found in houses where electricity has had entrance for lighting. We have Mr. Chandler very properly advising that in these very houses the loss of the lighting should be a reason for obtaining the installation of additional gas-heating apparatus. That is a point which should not be neglected; it supplies a cause for additional activity. The drop of consumption even for lighting makes the capital expended on service, meter, &c., less profitable than before. Prepayment meter consumers, too, should receive consideration in the matter of sales promotion. Mr. Chandler would loan free of cost to all approved slot consumers a small gas-fire. The capital cost would not be great. In his district a high-class inverted burner is also supplied to the slot consumers at a trifle less than cost price —the fixing being free. The special terms at which these burners are sold are more than counterbalanced by the reduced number of calls for the complaint fitter. These are means to the end of progress. But above all Mr. Chandler is a strong follower of the policy of free periodical maintenance, except where lighting fittings are concerned, in which case the charge should be confined to the materials used. There is a diversity of opinion on this point. Mr. Sandeman is an example. He prefers to make a charge of 2d. per burner per visit for labour, and to supply materials at ordinary selling prices. His experience is that "if people want regular burner maintenance, they will not object to pay for it." Our experience is that people who will not pay for regular burner maintenance are those whose burners get out of order; that their houses are good breeding-places for discontent; and that in consequence they are the most approachable by the electrical competitor. In view of this, our belief is that as time goes on it will prove more costly to gas undertakings not to do the work of maintenance than to do it. There is such a thing as being too late! The first trench in protection against competition is maintenance in all things, even if it costs a small fraction of a penny per therm; nothing, we think, will shake our belief in this. But maintenance alone is not sufficient. It must be accompanied by efficiency in men and methods, and the lowest possible price per therm. Those are the lessons that Mr. Chandler sought to impress by his paper; and we heartily agree with him.

Waste Heat in Carbonizing Plants.

THERE was a very interesting and suggestive discussion at the meeting of the Southern Association of Gas Engineers and Managers, on the paper by Mr. J. S. Thorman treating of the utilization of waste heat from carbonizing plants. We expected this when writing the editorial article on the subject which appeared last week, and in which there was a little criticism of certain data in the contribution. In view of this, we will only make reference on this occasion to a few of the points that were raised by speakers at the meeting. Carbonization practices vary so much that, even with the same types of plant, the temperatures of the waste gases must also vary; but there is good ground for thinking that Mr. Thorman (whose work in this regard was deservedly generously praised) is not far wrong when he indicates that, without very careful investigation, there is a disposition on the part of engineers to err rather on the low side as to the actual thermal value of the waste gases, and as to the amount of waste heat available if proper precautions be taken. United with this point is the one as to the amount of heat that is required in the carbonizing process, and what proportion of the heat actually delivered can really be classified as "waste." Dr. R. Lessing made some striking comments on the point. Heat is needed for raising the temperature of the setting and of the charges to the required extent for carrying out the process; this, *plus* the heat to compensate for radiation losses, is all that is positively required. Beyond this, we come into the realm of waste heat. Having regard to this, what is being done now in respect of the preservation and recovery of heat in the carbonizing process is only the beginning of things; at any rate, Dr. Lessing feels justified in anticipating that in a few years we shall be doing much better and getting much nearer to theoretical possibilities. We all hope this will be so; and then Sir Dugald Clerk and Professors Smithells and Cobb will have to revise their classical report on the subject of gas production efficiencies. Even in respect of radiation losses—a subject which has not received anything like the amount of consideration that it should have in connection with carbonizing plants—Mr. Thorman has shown how he has conserved by insulation a considerable amount of the heat of the waste gases; and there is not the slightest reason why, if this can be done in one part of the system, something more cannot be accomplished in other parts.

However, we live and learn, and thus make progress; and the practice of one time is succeeded by new practices which show a higher efficiency. The regenerator was applied to horizontal settings with a view to securing greater heat in the process from the fuel used, and thus fuel economy; and it has achieved its purpose. Last week we anticipated that at the meeting there would be some criticism of the high temperatures attributed by Mr. Thorman to waste gases. The expectation came true. There was a good deal of scepticism respecting the statement that with regenerator settings the available heat in the waste gases is about 750° C.; and Mr. Sheridan (Mr. Thorman's Assistant, who was present with Mr. Cheeseman, in the regrettable absence of their chief), knowing the care exercised in making the experimental investigation, holds, despite criticism, that with a combustion chamber temperature of 1350° C., and carbonizing at full capacity, the 750° is fully justified. Now comes a new question, in view of the proved economies of the waste-heat boiler — particularly when worked to its highest efficiency—and in view of the expense of regenerators. It is whether it would not pay to cut-out the latter in horizontal settings, and get all the value possible from the waste-heat boiler. It is a matter of relative economy. Mr. J. Wesley Whimster asked which is the more economical, because if the waste-heat boiler can assert a superior claim, then it is a question whether the life of the regenerator is not threatened. But just as, proverbially, threatened men live long, so we think will regenerators in connection with our carbonizing practices. Nevertheless, the point struck the President (Mr. Percy S. Hoyte); and he suggests that the elimination of the regenerators from horizontal retort houses when putting in waste-heat boilers might form the subject of a paper. We agree, and think it would supply a highly controversial topic for debate.

There was criticism of the amount of steam obtained in the test results per pound of fuel used in the producers —5·36 lbs. at 113 lbs. pressure (dry basis), or 5·27 lbs. ($2\frac{1}{2}$ p.ct. moisture). But it appeared to have been overlooked by those who regarded the steam production as high, until Mr. Frank Livesey directed attention to the point, that the temperature of the feed water was also high—155° Fahr.; the temperature having been raised by the exhaust steam from the gas-pumping station. But criticism of the data notwithstanding, an outstanding feature of the discussion was that no one disputed the economy that resides in the waste-heat boiler worked efficiently in association with carbonizing plants. Mr. J. Fisher referred to the two boilers that were installed at Tottenham in conjunction with the Woodall-Duckham vertical retorts. The installation cost £6877. Taking interest, depreciation, and repairs at the generous figure of $21\frac{1}{2}$ p.ct., the annual capital charge amounts to £1479. The fuel saving is 90 tons a week, which, at £1 a ton, amounts to £4580—thus showing a net saving of £3100. In other words, the total cost of the boilers will be extinguished by the savings in two years.

The paper by Mr. Thorman is a striking and valuable contribution to the subject of waste-heat utilization. Some of his figures, as indicated in our comments last week, are open to question; but this does not detract from the importance and value of the contribution in respect of its general tendency and conclusions.

Sulphate Propaganda and Quality Effects.

IN the circumstances of the times, and having regard to demand and present and prospective output of nitrogen compounds, there can be no question that the policy the British Sulphate of Ammonia Federation have been pur-

suing is finding justification, and will do so still more in the future, which means that legislative foresight has been displayed rather than the desire for larger immediate profits. Our belief in this is based on recent market developments in favour of sulphate of ammonia, despite the keener competition that prevails—not only from nitrate of soda, but from newcomers in the fertilizer world. Simultaneously with their advent, there is a growth in the utilization of chemical fertilizers, and yet this movement is under conditions that are industrially bad as well for the farmer as for other enterprises. The development is partly due, so far as sulphate of ammonia is concerned, to the steady propaganda work that has been carried on by the Federation, and to the greater appreciation by fertilizer users of the improved quality of the British product, which has done much to help to recapture markets abroad from which we had been more or less temporarily estranged. Better quality has indeed been a big factor in raising our sulphate of ammonia status overseas. In the year 1920-21 we exported from the United Kingdom a larger quantity of sulphate of ammonia than the United States; but in 1922-23 the latter exceeded this country by about 3000 tons. Looking, however, at the exports so far this year, we doubt if this difference in favour of America will be maintained. Our own exports—as was shown by the annual report of the Federation and the speech of the Chairman (Mr. D. Milne Watson) as published last week—have increased, and are now month by month doing so; but they are still a long way behind the sales to customers abroad in 1913 and 1914. But as against this, the home use during the year under review was more by 100,000 tons than the estimated consumption for 1913, although about 100,000 tons behind the stimulated use at home during the years 1917 to 1919. There were causes for the flights in home demand in those years; and, of course, the circumstances of last year were not conducive to maximum purchases on the part of British farmers. In view of this, the position cannot be accounted at all bad, nor can be the prospects.

For the sulphate of ammonia trade of this country, it has been a good thing that, during the recent difficult years, the Federation were in existence, and steadily pursued that commonsense policy which undoubtedly saved the complete wrecking of the market, and maintained the position of sulphate of ammonia in the competition which the superabundant availability of nitrogen compounds made very severe. Price, propaganda, quality, and intelligence as to movements the world over, have each and all had their part in the operations and services of the organization. The price in 1922-23 was about 10 p.ct. higher than in the preceding year, but this followed a fall of no less than 41 p.ct. from the level reached in 1920-21. Buyers, too, all over the world are now well informed as to the standard of quality to which most British makers at present wisely work, and which is the result of eight years' steady endeavour on the part of the Federation. As the Chairman says, in this country we have set-up a standard which few of our competitors have attained and none surpasses; and now 70 p.ct. of our output is acid-free and of neutral quality. This is very satisfactory; and it should help to extend British business in the future when things become more normal. A cheering point is that during the last decade there has been an increase of no less than 53 p.ct. in the world's consumption of sulphate of ammonia, and this notwithstanding the production of cyanamide and other newer forms of nitrogen. This being so, though we have to look forward to still greater outputs of the synthetic makes, the return to more normal conditions, combined with the high quality of the British commodity, should do much to help to produce a satisfactory balance. Coincidently the costs of manufacture should diminish; for, as Mr. Milne Watson contends, the price of sulphuric acid is now far too high, and ought to be reduced. There were a few plain words to the acid makers on the subject; and perhaps they will pay some heed to them. A number of interesting comparative statistics were given in the report last week, which show how vastly conditions have varied compared with pre-war. They are worthy of study by all interested in the market; for much regarding the past and the potentialities of the fertilizer market are reflected in them.

While congratulating the Federation upon the intrinsic value of their work, there is one more point which deserves mention. Last year it was stated that Synthetic Ammonia and Nitrates, Ltd., had thrown in their lot with the Federation. Now we see that the Federation are qualifying for the right to add the word "Empire" after "British" in their title; for they have taken into membership the Canadian producers. Where so many makers are of one mind as to the value of the Federation, it is strange that a few still hold aloof from membership, and that of an organization which has so well proved its worth.

The Daily Press and a Gas-Main "Explosion!"

THE daily papers last week unconsciously did their best to set tongues wagging and to cause an amount of fear among the timid members of the public by publishing startling accounts of the "explosion" of a gas-main under Newington Causeway. Of course, the education of the newspaper reporter does not include knowledge of the elementary fact that there cannot be an explosion of a gas-main or of anything else containing gas unless there is sufficient air present to form an explosive mixture, and unless there is a means of ignition. It was stated that the noise and force of the explosion gave a sharp reminder of the air raids in London, that the City and South London Tube was blocked, and that a cavity was formed in the roadway large enough to accommodate an omnibus. A good deal of embroidery was added to the event, which admittedly was of an alarming nature for those who were in the immediate vicinity. But the real facts were presented to the public on Thursday, through a joint communication to the Press by Messrs. Mott, Hay, and Anderson, the Engineers to the Railway Company, and Dr. Charles Carpenter, the President of the South Metropolitan Gas Company. The facts were simply these: The South London Tube is being enlarged; and in the course of the excavations, contact was made with an old storage well. There was an inrush of sand and water into the tunnel—leaving unsupported the surface of the road immediately above. Robbed of their support, the gas and water mains, electric cables, and so forth collapsed, and from the fractured main gas escaped. How the explosive mixture thus formed in the cavity became ignited has not yet been explained. Probably it was accomplished electrically; but perhaps some light will be thrown upon the point at the inquiry which the Ministry of Transport are holding into the accident. But it will be seen from the sequence of contributory facts that the hole formed in the ground was the cause, and not the result, of the explosion. It was as well to have this made clear to the public as quickly as possible, as the idea of gas-mains under the public highways being capable of exploding without any external aid might have spread a fear that every street contained under its surface something akin to, or even worse than, a powder magazine. As the joint statement plainly indicates, nothing occurred in Newington Causeway which need shake the faith of the public either in the security of tube railways or of gas-mains reposing subterraneously in the streets.

A Record Day's Gas Consumption.

In the course of last month, some very disagreeable fogs and very low temperatures were experienced in London; and these conditions were particularly good for gas consumption. During the first ten days of the month, the lowest minimum temperature for November for fifty years was registered in the London area—22° at Kew on the 8th inst.—and on Monday of last week, the lowest minimum temperature recorded was only 2° higher. This compares with the lowest minimum during November, 1921, of 24° on the 10th and 13th of the month. However, on Monday of last week, the Gas Light and Coke Company had their record consumption. It amounted in the twenty-four hours to no less than 156,000,000 c.ft., which, at the declared calorific value, means that the Company sent out no less than 78,000,000,000 B.Th.U., or 780,000 therms. There are a good many managers of gas undertakings who would be pleased to see a similar aggregate consumption for 365 days.

New Offices of the "S.B.G.I."

We heartily congratulate the members of the Society of British Gas Industries upon their new home at No. 56, Victoria Street, S.W. The Secretary (Mr. Arthur L. Griffith), who will be living a big part of his life there, is very proud of the fresh possession; and he has good cause. The Society have now such an important place and part in the world of the gas industry, and enter so largely into its co-operative activities, that it is none too

early for them to have moved from the back streets of the City into the broad thoroughfare of Westminster, where engineers are gathered, and engineering visitors to London generally wend their way. The Council room and offices are admirably adapted and furnished for their purposes; and if anyone wants to see good interior gas illumination, he will find it there. Lord Weir, the President, was unable to be present on Tuesday of last week to perform the opening ceremony; but Lord Riddell—last year's President—cheerfully came among his old friends, and did the needful. The other organizations of the industry were well represented by the President of the National Gas Council (Mr. D. Milne Watson, who is also President-Elect of the Society), by the Hon. Secretary of the Institution of Gas Engineers (Mr. W. E. Price), and by Mr. F. W. Goodenough, the Executive Chairman of the "B.C.G.A." Mr. F. C. Tilley, the Chairman of the Council of the Society, heartily welcomed all the visitors and members who were able to attend; but the number was greatly reduced owing to the bad conditions of the weather for travelling. However, the new home had an excellent inauguration; and we predict that it will be the centre of much beneficial activity for not only the members of the Society but the industry generally.

Air Entrainment by a Gas-Jet.

Dr. J. S. G. Thomas and Mr. E. V. Evans, of the South Metropolitan Gas Company, have been further pursuing their studies into the question of air entrainment by a jet of gas issuing from a small orifice in a thin plate; and the work and results form the subject of an article in the "Philosophical Magazine." The editor has kindly allowed us to give a digest of the work; and this will be found on p. 639. As there explained, the object of the research was to consider the dependence of air entrainment by a jet of gas upon the density of the gas in the jet, and upon the density of the air into which the jet issues—the experiments being confined to hydrogen, coal gas, air, and carbon dioxide. The results, together with an interesting theory, are presented in the abstract.

Appeals on Gas Examiners' Reports.

There seems to be some laxity on the part of gas undertakings in the matter of appealing against the reports of gas examiners when they show a deficiency in calorific power or purity, if there is reason for believing that they are inaccurate, or default was not due to negligence. It must be that in many cases an appeal to the Chief Gas Examiner would have caused the report to be annulled, or have produced a certificate that the default was not substantial or was due to unavoidable circumstances. It is a pity to allow the imposition of forfeitures or the taking of summary proceedings where there is no justifiable occasion for them. Appeals must be lodged within seven days of the receipt of the report.

Public Works, Roads, and Transport Conference.

The session arranged by the Institution of Gas Engineers at the Public Works, Roads, and Transport Conference was held last Wednesday, with the President of the Institution (Mr. S. Tagg, of Preston) in the chair. The proceedings were very successful. The papers by Mr. Harold E. Bloor, of York, on the "Quality and Composition of Town Gas," and by Mr. Stephen Lacey, Distributing Engineer to the Gas Light and Coke Company, on "The Position of Gas-Mains in Public Highways," gave rise to excellent discussions. We commence the report in this issue, and shall conclude it, together with a few comments, next week.

Gas Companies and Electricity Powers.

Several statutory gas companies have obtained electricity supply powers; but the path to this authorization does not appear to be altogether free from difficulty. Messrs. R. W. Cooper & Sons, Parliamentary Agents, have been looking into the matter, and have drafted a Bill which has for its object the overcoming of the difficulties. The Gas Companies' Protection Association are giving their sympathetic, but not financial, support to the measure. It is hoped that it will be introduced next session as a private member's Bill, if the Government are not prepared to adopt it. The provisions of the measure are not known to us; but it is understood that the Board of Trade and the Electricity Commissioners are favourably disposed towards it. This ought to help it through. Dr. Carpenter referred to the Bill at the recent annual meeting of the Association. He glanced back. Many of us have often done so; and as the gas industry has progressed and developed its resources, the thought has frequently occurred how it would have been to the advantage of the country and of the community if every gas-works had been made the sole centre for the supply of both gas and electricity for light, heat, and power. While, as Dr. Carpenter says, there is little use speculating now as to what we might have done, he supposes that, if we had an opportunity of being again in the position of thirty or forty years ago, things would have been done differently with regard, at any rate, to the supply of electricity. He is perfectly certain that if one set out to ascertain what were the ideal conditions for supplying energy for light, heat, and power, it would be decided that the supply should be in the hands of a single properly regulated undertaking.

PERSONAL.

We are pleased to learn that Dr. ARTHUR SMITHELLS, who lately retired from the Chair of Chemistry, has had conferred upon him by the Council of the University of Leeds the title of Emeritus Professor.

Following upon the death of Mr. James Hutton, who was Chairman of the Cowdenbeath Gas Company since its resuscitation in 1901, Mr. JAMES MILLER THOMPSON, W.S., of Edinburgh, has been appointed to fill the chair.

Mr. J. WILFRID DRAKE, Chairman and Managing Director of Messrs. Drakes, Ltd., and a member of the Halifax Town Council, received severe injuries to the right arm, and suffered shock, in a motor accident last week, while returning from a week-end at his Southport residence. His wife and daughter were shaken, while the chauffeur was not hurt in any way. Mr. Drake was driving the car, which, at a road junction near Preston, skidded and crashed into a house. Mr. Drake is reported to be progressing satisfactorily. The injury to the arm is not as bad as was at first feared.

At a meeting of the Birmingham Gas Committee last week, illuminated addresses were presented by the Lord Mayor (Alderman Williams) to Mr. WILLIAM LYCETT, who retired, as District Inspector, after 40 years' service in the fittings department; and to Mr. CHARLES HENRY CORT, who retired after 44 years' service. Mr. Cort commenced in the fittings department, and held the position of Mains and Services Inspector when he retired.

Mr. MATT DUNN, M.I.Mech.E., of Mansion House Chambers, Newcastle-on-Tyne, late Engineer and Manager, Stockton-on-Tees Gas-Works, has been appointed Chief Sales Representative for the North of England for Messrs. Joymanco (Brighton), Ltd., manufacturers of gas-appliances, Hove, Sussex.

Among the names figuring in the list of successful candidates for the B.Sc. (Hons.) London University external examinations are those of Mr. A. D. CUMMINGS and Mr. N. J. IVESON, who are both employed on the Chemical Staff of the Newcastle-on-Tyne and Gateshead Gas Company.

BENZOLE RESEARCH CHEMIST.

A New Appointment.

At a recent meeting the Council of the University of Leeds appointed Mr. Wilfred H. Hoffert, M.A. (Oxon.), B.Sc., A.I.C., to the post of Research Chemist to the Joint Research Committee of the National Benzole Association and the University, in succession to Prof. E. C. Williams, who resigned his appointment on Sept. 30, on his election to the Ramsay Memorial Chair of Chemical Engineering in the University of London.

Mr. Hoffert took a first class at Oxford in 1914, in the Final Honours School of Natural Science (Chemistry), and was also awarded a Research Scholarship at Jesus College. During the war he served in Gallipoli, and later joined the British Aviation Mission to America. In 1919 he was appointed to a Research Fellowship of the Salter's Institute of Industrial Chemistry, and also held a temporary tutorship at Christ Church, Oxford. Since then he has served as Research Chemist to a Lancashire firm engaged in the coal tar industry, and has also had experience at H.M. Fuel Research Station, Greenwich.

Mr. Hoffert will work in the Department of Coal Gas and Fuel Industries of the University of Leeds, under the supervision of Prof. Cobb, the work being directed by the Committee formed by the National Benzole Association and the University of Leeds for the purpose of investigating the problems of the benzole industry, more particularly in connection with the possibilities of increasing home supplies of motor spirit from coal.

ELECTRICITY SUPPLY MEMORANDA.

WE see that Mr. A. F. Berry, of "Tricity" fame, has been lecturing at one of the electric salesmen's conferences in London on "The Sale of Heat"—in the form that is provided at a great waste of heat energy. The sale of heat is an excellent subject during the cheerless cold weather which we have lately been experiencing. When heat is required most, the public want it on the cheapest terms possible. They need it for long-hour use, and plenty of it. If they do not mind the labour involved by coal, they will use that heat-giving agent, which, however, at current prices and at the efficiencies obtainable from it, cannot show much saving when compared with gas; and gas has an intrinsic value to the householder in that it does not impose labour, and need only be used as and when required. When one considers that to put electrically the potential heat represented by a therm (say at 8d.) into the possession of a householder, 29 units of electricity will be required—costing at 1d. 2s. 5d., at 1½d. 3s. 7½d., and at 2d. 4s. 10d.—there is little need to look further for a reason for the reluctant adoption of electricity for heating by the public. And say what they like, electricians know full well that electricity for heating could not be supplied at those prices, if the demand for it took the vagarious flights that are experienced in the case of gas. For instance, take Monday of last week, with its fog and cold—the Gas Light and Coke Company were called upon to supply in the twenty-four hours no less than 156 million c.ft. of gas, or 78,000,000,000 B.Th.U., or 780,000 therms. To supply a like amount of heat energy, the electricity suppliers in the same area would have been called upon to send out more than 22,800,000 units in the twenty-four hours. In saying this, we may have it pointed out that electrical energy can be converted into heat at 100 p.ct. efficiency, while gas shows an efficiency for heating purposes of 75 p.ct. Of course, it is ridiculous to talk of 100 p.ct. efficiency for electric fires. Testing the heat-giving power of two different makes of electric fires, consuming the same metered quantity of current per hour, a difference in heating result is found which would astonish those who so blandly talk of 100 p.ct. efficiency. But assuming the accuracy of the 100 p.ct., an electric therm costing 2s. 5d., 3s. 7½d., or 4s. 10d. could be equalled in heating by gas (costing 8d. per therm) for an expenditure of 10·6d. Just think what the difference in cost would be multiplied by the hours of use during the winter!

Sale of Heat in Cold Weather.

To turn to the paper by Mr. Berry. In the very first paragraph, there is interest and an exposure of a want of knowledge. He refers to the purity of electric heat, because there are no products of combustion; and this purity he thinks is of considerable value in cooking, particularly in the oven. It is not a question of the purity of electric heat, but whether the heat of other agents is produced in the company of products that are deleterious to health. If they are not, then there is no great virtue in the claim advanced by Mr. Berry on behalf of electricity. He asserts that he does not wish to be unfair to any competitor; but when he deliberately starts running for electrical salesmen a new fictitious hare as mentioned in the succeeding paragraph, we must absolutely question his fairness. He asserts that he has heard it said a hundred times in an electric restaurant: "How very clean the food tastes here." All our big caterers use gas; and in millions of homes in the country, and in more millions in other parts of the world, gas cooking has been in use for decades. All over the world people have praised food cooked in ovens heated by gas; millions have been fed all their lives by food so cooked. Gas cooking is not something modern; and Mr. Berry's experience is very slender compared with the experience of gas cooking in all civilized countries. Yet he comes along to-day, and says: "English food is so simple that in its plainness and simplicity it shows up any taint due to absorption of products of combustion when cooking." That is very silly. It does not show any deep thought. How can food that is exuding moisture be absorptive at the same time; and how, when the exterior is sealed by exposure to heat, can it then be absorptive? Mr. Berry talks much of products of combustion. Can he tell us the chemical constituents of those products? If so, will he further inform us in what way they are deleterious to food? And then explain why with gas cooking so general, our health statistics have been improving, and why the world had so many healthy men to send to and win the war—despite the fact that so many had been brought up on gas-cooked food? Really, facts are more persuasive than assumption.

Impurity and Practical Experience.

But Mr. Berry gives the best possible certificate that he does not know the truth of these matters when he says: "I cannot help expressing the opinion that the terrible increase of cancer and diseases affecting the internal organs is probably due to the fact that tarry and other products of combustion are absorbed into the human system far more than they used to be in the old days before combustion took place in the oven itself. . . . I ought to remind you of the ascertained fact that cancerous growths have long been known to occur most frequently in industries connected with the handling of tar products. This matter should certainly receive the very closest attention." Is it fair to put into circulation an idea of this kind, unsubstantiated by scientific proof? If Mr. Berry had known more as to the processes of gas manufacture, he would have been aware that, in the combustion of purified gas, there are no tarry emanations. There could not be even if tarry atoms were in the gas as delivered at the burner. But as a matter of fact the tar is removed in the various purifying processes to which the gas is subject. We ask Mr. Berry to tell us how long an oxide of iron purifier would continue active if the gas contained tar? Really those who have technical knowledge of these matters will be highly amused over the views on gas of this maker of electric cookers and would-be teacher of electric salesmen. We should really like to probe deeper the knowledge of Mr. Berry as to the tarry constituents in purified gas, and how those tarry constituents pass through the high-temperature mechanism of gas-flames, and escape with the ordinary products of combustion. We know that wonderful things do take place hypothetically in the interests of electric heating and cooking; but really, Mr. Berry, this is the most marvellous of them all. Now we will agree with him if he will leave gas, and turn to coal. In that unconsumed carbon which escapes from the coal fire, passes up the chimney, and out into the atmosphere, there is a quantity of tarry particles in every unit. The specific gravity of the tarry particles causes them, when dissipated in the open atmosphere, to have a preference for descending rather than ascending; and they add to the impurity of the atmosphere that we poor human beings breathe. If Mr. Berry had made a chemical test of a few cubic feet of the air of London last week, he would have found more tarry matter in it than he will discover in a gas-oven in a lifetime. We hope this is the last we shall hear from the electricians of this absurd "opinion" of Mr. Berry. Like the shoemaker, he had better "stick to his last."

Tarry Matter in Products of Combustion.

Mr. Berry also journeyed into the field of electric heating, the surface of which he finds electricity supply undertakings have only just "scratched." There were evidences in the discussion that the heating business is not all plain sailing. Difficulties are there of which the cheery optimism of Mr. Berry cannot dispose. As a maker of electrical appliances, he naturally wants to sell them; but those who come into contact with the public know that between what the manufacturers would like and the public will have there is a good deal of space that requires bridging over. One of the speakers was Captain Donaldson; and he thought a point of recommendation for the electric fire is that with it the user knows absolutely what it is going to cost. He can only tell that per hour. He does not know how many hours he will require the fire during the heating season. If he knew this, and what the actual total cost would be, the probability is he would never have the fire installed. Capt. Donaldson spoke of one difficulty which does not trouble the public, but does electricity suppliers. That is the serious heating peak, which is accentuated on a foggy day, when both light and heat are required. There was also some question in the mind of Mr. W. R. Rawlings as to whether it is good from the economical point of view to use electricity for the whole heating of a house. A very positive answer can be given to that. The electricity supply industry will do itself immense and permanent damage if there is continued postulation that electric heating is economical. It seems that he keeps his house heated up this time of the year to about 55°; but this is not done electrically. Electricity is only used for boosting-up the temperature. His plan is to warm the house by coke or anthracite, and have an electric fire in each room to get extra warmth. Then we observe that one of the speakers likes selling that vague commodity "the electrical idea" rather than electricity; and others are all out for going for the medical fraternity to get them on their side. It is no use talking nonsense to medical men who have had experience of gas-fires. And it will be waste of breath to tell them that electricity is as cheap as gas for heating.

Electric Heating.

We have heard of electrically heated suits for airmen, table cloths and carpets for household purposes, and low-temperature panels. Now the "Electrician" calls attention to electrically heated floors. It obtains the information from "Schweizerische Bauzeitung." Electrically heated floors have been introduced into Swiss dwelling-houses. Of course, in Switzerland electricity is generated by water power very cheaply. This plan of heating is best suited to rooms with stone or concrete floors or mosaic flooring. The heater coils are placed within iron pipes, which are embedded in the flooring, at suitable distances apart, but near the windows closer than in the middle portion of the room. The coils are drawn into the pipes like cables, and are built-up in links to retain flexibility. The heaters are mostly fitted with two resistance coils, to be coupled in series, or in parallel, or to be used singly. This is considered preferable to providing special switches for separate heaters.

Floor Heating.

An interesting case has been before the Woodbridge County Court; but it is still *sub judice*, so we will only refer to the facts. It was a case in which Mr. Cyril Catchpole was sued by the Felixstowe District Council, through their collector, for the sum of £26 6s. 4d. for the supply of electricity and meter-rent. A sum of £12 had

A Disputed Account and a Technical Point.

been paid into Court. We are particularly interested in the admissions of Mr. Vulliamy, who appeared for the plaintiffs. He stated that the charge for current was calculated at 2d. per unit consumed and 6d. in the pound on the assessment of the house. He mentioned that the defendant used electricity for all purposes—lighting, heating, and cooking; and then this confession: "Everyone knows that, unless great care is exercised, electricity is apt to be rather expensive in a large house." As a rule, it is more than "apt to be expensive;" it is expensive, having regard to the service rendered in comparison with other means of obtaining heat. It is a pity that something more is not done to educate the public in this regard. To do this would be rendering a public service. Defendant, it was stated, has in use four radiators, an oven, and two electric plate heaters. It seems that the complaints by him as to excessive cost have been going on quarter after quarter during the past two years. At the end of the March quarter, the Secretary of the electrical undertaking suggested that the meters should be tested. As the result, one meter was found to be 12½ p.ct. fast, and the other 6 p.ct. The accounts were adjusted accordingly. The usual complaint was made at the end of September; and £12 was offered in settlement, but was not received. Hence the action. But the case was abruptly interrupted. On behalf of the defendant, it was submitted that, under the Electricity Supply (Clauses) Act, if a dispute arose as to the correctness of a meter, it was to be determined by an inspector, or, if one was not appointed by the Council, then by one appointed by the Board of Trade. There was some discussion upon the point; and, in the result, the case was adjourned for three months, in order to permit of the appointment of an inspector. It was hinted that probably the Court would not be troubled with the case after that.

Small Stations and Internal Combustion Engines.

A letter which has our complete sympathy has appeared in the "Electrical Times." It refers to the policy of the Electricity Commissioners in working to effect the closing-down of small electricity stations in favour of the large super-power ones, notwithstanding that some of the smaller ones with internal combustion engines can match the super-power stations in lowness of generating costs, without the heavy costs and losses in transmission. The writer of the letter is Mr. H. H. Day. He points to the opportunities that centralization of generation will give to those who desire for any cause to stop the power supply to large areas. A powerful weapon this may prove in the hands of labour if the example of Fulham is followed; and it would be a terrible disaster in time of war, when engineering plant has to work at full load and full time, if the enemy successfully placed a few bombs in the vital parts of large generating stations. The purpose of Mr. Day's letter is to urge that there should be more co-operation between the makers of internal combustion engines, to ensure that the economies obtained by the use of such engines are properly recognized, and that the present grandiose electricity policy is adjusted to allow of more economical and immediate developments of existing stations.

ANALYSIS OF COAL.*

Fuel Research Board Recommendations.

Many analyses of various coals have been made and published but there have been no standard methods of conducting the analyses, and different investigators have adopted variations in their procedure. In consequence, the results are not always comparable. The Fuel Research Board, from their inception, have had in view two main lines of research, one of which consists in a survey and classification of the coal seams in various mining districts from the physical and chemical aspects, with a view to collecting the necessary data for the most economic utilization of the coal available. In order to ensure that the results of examinations of coal made for the purpose of the survey should not suffer from any uncertainty, the Board appointed a Committee to deal with the question of analysis, and prepare detailed instructions for carrying out the various tests. An interim report of this Committee is now published under the title "Physical and Chemical Survey of the National Coal Resources. No. 2.—Interim Report on Methods of Analysis of Coal." The recommendations in this report have been adopted by the Fuel Research Board, and the hope is expressed that they will also be generally adopted by analysts throughout the country, so that results shall be strictly comparable. A full report, embodying an account of the experiments made by the Committee, will be presented to the Fuel Research Board, with a view to publication at a later date. Meanwhile, to avoid unnecessary delay, and recognizing the fact that many analysts are less concerned with the evidence on which conclusions are based than with the conclusions themselves, the interim report has been issued. It is the intention of the Board to review the publication periodically, to verify any new suggestions by experiment, and thus to present to analysts and coal-users generally an authoritative statement of the best current practice in the methods of valuing coal.

* "Physical and Chemical Survey of the National Coal Resources. No. 2.—Interim Report on Methods of Analysis of Coal." Published by the Department of Scientific and Industrial Research, and obtainable at H.M. Stationery Office, Imperial House, Kingsway, W.C. 2. Price 1s. 6d. net.

The determination of moisture is not a difficult test; and the method adopted by the Committee is in general use. Regarding coals which show special liability to oxidation, drying should take place in an atmosphere of dry nitrogen or carbon dioxide. The estimation of ash also calls for little comment. For commercial purposes, the ash is usually accepted as a sufficiently accurate measure of the proportion of inorganic matter present; but, of course, it differs in composition from the original inorganic constituents. The expulsion of water from kaolin and calcium sulphate, of carbon dioxide from carbonates, and the conversion of iron pyrites into ferric oxide during ignition, are all changes involving a loss of weight.

The methods for the determination of volatile matter have always given rise to much debate; it is consequently of interest to describe this test in detail. One gramme of coal is weighed in a platinum crucible closed by a well-fitting internal capsule lid. The covered crucible is then supported on platinum or nichrome wire, and is heated for seven minutes at a temperature of 925° ± 25° C. The crucible is allowed to cool, and is then weighed. The loss of weight represents the volatile matter, including the moisture, in the air-dried sample. The method of heating is all important in this test; and the Committee recommend the use of a gas or electrically-heated muffle furnace, or an electrically-heated tube furnace. To minimize loss due to oxidation, which appears to be the chief source of error, a small tray charged with charcoal should be placed at the back of the muffle, and the front should be closed by a plate of uralite, or other suitable material, to which is attached a wire cage filled with charcoal. If an open flame is used for heating, the gas pressure and the position of the crucible in the flame should be adjusted to give a temperature of 925° ± 25° C. on the bottom of the covered crucible. The temperature should be measured, before making the determination, by means of a thermo-couple passed through a central opening in a nickel cover, and resting on the bottom of the crucible, or may be regulated so that the fusion point (940° C.) of potassium chromate, placed on the bottom of the crucible, is just reached. If the necessary temperature cannot be obtained with an open flame, the crucible must be protected from excessive heat losses due to convection and radiation. Simple means of effecting this are to surround the crucible by an asbestos-lined cylindrical iron shield, which is attached to the tube of the burner, and is provided with a regulator for the adjustment of secondary air. This test, it will be noticed, is the one recommended by the American Chemical Society. Perhaps readers of the "JOURNAL" will remember the criticisms of the method which were put forward by Prof. W. A. Bone, who drew attention to the catalytic influence of hot platinum on such thermal decompositions, and also suggested that it does not enable a sufficiently reliable judgment to be formed about the coking properties of the coal.

As to coking properties, however, the adoption of a modified Campredon test is recommended. In connection with an inquiry into the coking-coal seams of Scotland, instituted by the Scottish Advisory Committee on Iron and Steel Production, the results obtained by this method showed a surprisingly close agreement between the caking index as determined in the laboratory, and the practical estimate of the value of the coal produced by heating the ground coal in the coke-oven. The weight of sand which can be bound into a coherent mass by unit weight of coal is determined by heating 25 grammes of a mixture of coal and sand in varying proportions in a covered platinum crucible. The residue is considered to be sufficiently coherent if the mass, after removal from the crucible, is able to support a 500-gramme weight. As this condition may be satisfied when the contents of the crucible have not been entirely cemented together, and since the proportion of loose powder rises steadily as the ratio of sand to coal is increased, a limitation of the permissible proportion of loose powder is necessary. This has been arbitrarily fixed at 5 p.ct. The more recent practice of using electrode carbon in place of sand, and the use of other inert materials, are being further investigated.

It is impossible to comment on all the methods dealt with in the report; but attention may be drawn to the process recommended for the estimation of sulphur—the Eschka method. It is not mentioned in the report that the best results are obtained by using an electrically-heated muffle furnace. When a gas muffle or flame is used even with precautionary measures, the reliability of the test is impaired. In relation to this question we look forward to the detailed report to follow, for our interest is as much in the reasons for the choice as in the recommendation itself. There is no method given for the ash fusion test. As this is a highly important property and one which affects many processes, its omission is surprising.

As the ordinary laboratory methods of proximate and ultimate analysis of coal supply no direct information as to the quality and quantity of the gaseous and liquid products of carbonization, as to the rate of evolution of these products at different temperatures, or as to the influence of temperature and time of carbonization on the qualities of the resulting coke, the report concludes with a section on low-temperature and high-temperature assay of coal. There is also an appendix describing Sinnatt & Harrison's method of determining the carbon dioxide in coal.

Scottish Junior Gas Association (Eastern District).—The first visit of the session has been arranged for next Saturday afternoon, to Messrs. Alder and Mackay's New Grange Works, Edinburgh. The members will assemble at the works at 2.30.

VALUATION OF GAS-WORKS IN SCOTLAND.

[CONTRIBUTED BY A SCOTTISH EXPERT.]

The article on the above subject which appeared in the issue of the "JOURNAL" of Aug. 29 last (see p. 627) would appear to have been contributed by an English expert who is not thoroughly conversant with the established principles and practice of valuation in Scotland. The valuation of gas undertakings is admittedly technical, but Scottish Lands Valuation Assessors are alive to this, and to the difficulty of attaining uniformity of practice. Indeed, absolute uniformity is not possible, owing to special circumstances which are well known in Scotland.

In the article referred to it is stated that it was not until 1883 that any attempt was made by the various Scottish gas companies to have the principles of valuation settled. There was, however, no combination of gas companies in 1883 for this purpose. The judgment given in that year was the result of an appeal at the instance of only one company; yet the case settled the principle which has since been followed in Scotland in valuing gas-works. Observations by the late Lord Low in the Kirkcaldy Gas Light Company's appeal in 1905, disallowing cooking-stoves as tenants' chattels, are quoted in the article; but his Lordship's decision upon this point has been generally regarded by assessors as unsound, and for this reason ignored.

It is true that the adjustment of the tenant's capital (and particularly the fixing of the value at which the movable plant, &c., should be taken) frequently causes difficulties; but these are even greater south of the border than in Scotland, where, for example, Lands Valuation Assessors have an advantage over rating valuers in England when dealing with machinery and plant, in respect that they have a special Act of Parliament (yet not without defects) to guide them. The average amount of tenant's floating capital should be less in Scotland than in England, because rents are paid only twice annually—viz., at Martinmas and Whitsunday. Again, gas charges in Scotland are usually levied three or four times yearly, while the revenue from residuals and slot-meters comes in all the year round—facts which ought to be taken into account in fixing the number of months to be adopted in calculating tenant's floating capital.

The article also deals with the rate of interest to be allowed on tenant's capital. The fallacy underlying the audacious suggestion that the tenant is entitled to 10 p.ct. is that it is apparently assumed that he would have to borrow the capital embarked by him in the business. Every reputable tenant should be understood to invest his own, and not borrowed, capital in the movable plant required. It is hoped that no gas company in Scotland will be led to believe that it is justly entitled, under present economic conditions, to more than 5 p.ct. as a return in name of interest alone. Much higher rates prevailed during the war, but the Bank rate, which is the standard index of the value of money, is now back to the pre-war level.

It is also indicated that the Scottish system of deducting the actual occupier's rates paid during each year preceding that of valuation is erroneous, and that the English method should be substituted, whereby there would be ascertained in the first instance a valuation including rates, from which there would be deducted the estimated rates on the annual value ultimately fixed for the works and pipes. This method is doubtless well suited to the English system of local rating; but it is submitted that, in the case of a Scottish gas undertaking, as regards which the pipes may extend, even in one county, into a score of separate rating areas, and the valuation of which is founded upon the trading results of an average of three or five years, the Scottish method of dealing with local rates is, over any given series of years, sound. It operates, ultimately, with absolute justice to the tenant, since in Scotland a fresh valuation is made each year, and thus gives effect annually to the fluctuation not only in local rates but also in—what is much more important—the entire net receipts.

The writer of the article states that he disagrees with the Scottish practice of deducting only the *tenant's* rates, on the ground that, by leaving the owner's rates in the valuation fixed, both the owner and the occupier are made to pay rates upon a sum equivalent to the owner's rates. Such a contention proves that he does not fully apprehend the valuation and rating law of Scotland, under which a clear distinction falls to be made between the rates payable by the owner and by the occupier respectively. The owner's rates are therefore correctly included in the annual rent or value of the lands and heritages, and for this reason they cannot be legitimately deducted in ascertaining annual value on the revenue basis. This rule is universal in Scotland; and it is only right and proper that both owner and occupier should pay local rates upon what is *de facto* a component part of the annual rent or value of the hereditament. There can be little doubt that the Scottish Valuation Judges would dismiss any plea that the tenant, in estimating the gross annual rent or value of a gas undertaking on the revenue basis, is entitled to deduct the owner's rates as well as his own.

According to the detailed average valuation appended to the article in question, it appears that in a gas company's undertaking, with average gross receipts of £28,060, all that the owner is entitled to in name of rent is £1905—which, it is contended, should be further reduced by £600 for owner's rates. The owner of the gas-works would, therefore, have to be content with only £1305 per annum as return for his capital, whereas the tenant with much less invested is allowed £3585 in name of interest and profit, in addition to exceptionally heavy working expenses! In the opinion of the present writer, the general inference to be drawn from the specimen valuation under review is that it was put forward to attract the attention of credulous Scottish gas companies. It is submitted that even the sum of £1905 is far from being what the specimen valuation purports to be—viz., a fair *gross* annual rent or value, computed in conformity with the law of Scotland, of a gas company's undertaking, the average receipts of which amount to £28,060.

Net receipts are undoubtedly a better test of ability to pay than gross receipts, but they have not been quoted here because of the adverse effect upon the valuation of (*a*) the exceptionally high coal bill during the entire triennial period dealt with, and (*b*) the very questionable deduction of £2805 for "Cash at Bank" claimed (for twelve months) in addition to five months' abnormal working expenses. During each of the three years adopted the prices of Scottish coal were, owing to exceptional causes, much higher than for many years before. The prices for 1923 have been to date fully one-third less than those which prevailed during the three years covered by the valuation.

In conclusion, it must be pointed out that the specimen valuation referred to deals with the operations of a gas company or other body trading for commercial profit. There are, however, numerous gas undertakings in Scotland owned and managed by local authorities, who are prohibited by their Acts from making profit. The Scottish Courts have held that in such circumstances no distinction falls to be made, except as regards the items mentioned below, between landlord and tenant in dealing with the working expenses for valuation purposes, and that deduction should be allowed from the gross revenue of "all necessary outlays for management, maintenance, and repairs which are properly chargeable against revenue," *except* those relating to owners' rates and taxes, feu-duties, wayleaves, and Parliamentary expenses. In all such cases, it has been held that, in ascertaining the annual value on the revenue basis, no allowance in name of tenant's profits is permissible.

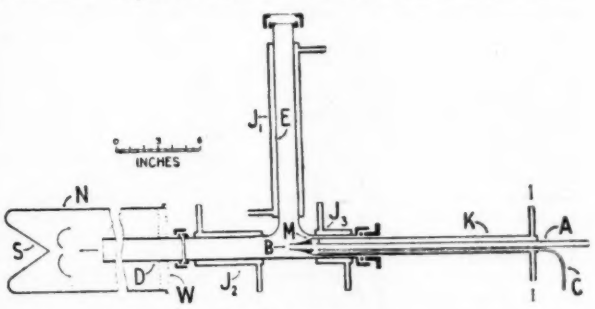
AIR ENTRAINMENT BY A GAS JET.

Abstract of a Research by J. S. G. Thomas, D.Sc., A.R.C.Sc., A.I.C., and E. V. Evans, F.I.C.

By kind permission of the Editors of the "Philosophical Magazine" we are able to give an abstract of a paper communicated to that magazine by J. S. G. Thomas, D.Sc., A.R.C.Sc., A.I.C., Senior Physicist, and E. V. Evans, F.I.C., Chief Chemist, of the South Metropolitan Gas Company, on "The Entrainment of Air by a Jet of Gas Issuing from a Small Orifice in a Thin Plate." The object of this research was to consider the dependence of air entrainment by a jet of gas upon the density of the gas in the jet and upon the density of the air into which the jet issues; and the experiments were confined to hydrogen, coal gas, air, and carbon dioxide.

EXPERIMENTAL.

As the results of research work of this nature depend so greatly on the method of procedure adopted, it is of importance to describe in detail the apparatus (of which a plan is given) and the precautions adopted to avoid distortion of the data obtained.



Plan of Apparatus.

In order to eliminate as completely as possible any effect upon air entrainment arising from a vertical column of gas lighter or heavier than air, the discharge and air induction tubes were mounted horizontally.

The discharge tube A was provided with a jacket K, through which water, steam, or other heating fluid could be passed. The remaining tubes in the neighbourhood of the orifice B and for some distance therefrom were similarly provided with jackets J_1, J_2, and J_3, and the whole of the apparatus comprising the discharge and induction tubes carefully lagged with cotton wool and felt. The orifice in the disc B was of such diameter that anomalous air entrainment did not occur within the range of pressures employed. The disc and orifice were prepared from a nickel-steel sheet, and the disc was soldered to the discharge tube. Pressure in the latter at a point about 1·5 in. from the orifice was transmitted to a water manometer through a chamber M brazed to the discharge tube and connected with the tube C. The pressure

was read by a microscope to within 0·02 mm. Air supplied to the discharge tube was dried by passage over calcium chloride. A hot-wire anemometer was inserted in the air induction tube E, to measure the volume of the air entrained by the jet, and was arranged in such a position that its indication was not affected by the temperature in the jacket J_1. The mixture of gas discharged from the orifice and air induced by the jet was delivered into a comparatively large cylindrical vessel N provided with a re-entrant conical bottom. The effect of external atmospheric disturbances on the jet was reduced to a minimum by providing the mouth of N with two layers of fine copper gauze W.

RESULTS.

Curves are shown representing the "aeration" of a jet of air at various pressures when discharged at temperatures of 14·4° C., 100·3° C., and 183·9° C. respectively, the jet issuing into air at very approximately its own temperature—*i.e.*, so that the densities of the air in the jet, and that into which the jet issued were equal. In each case the degree of air entrainment effected increased rapidly, and then more slowly as the pressure at the orifice was increased. The curves indicate that when a jet of air issues into air of the same density, the volume of air entrained at any definite pressure per unit volume of air in the jet is practically constant, and independent of the density of the air. A decrease of only about 1 p.ct. in the percentage aeration of the jet is shown when the temperature of the jet and of the air into which it issued was raised from 14·4° to 183·9° C. Results obtained when a gas issues into air of less or greater density are also given. In the case of carbon dioxide the aeration at all pressures is considerably greater than that effected in the case of a jet of air, while with hydrogen the aeration is considerably smaller. The incombustible constituents of coal gas generally are characterized by relatively high specific gravities compared with the combustibles, and it might, the authors think, be reasonably anticipated that, on this account, the degree of primary aeration of a jet of coal gas effected at any pressure would, *ceteris paribus*, be increased by an increase in proportion of these "inert" incombustible constituents. Under these conditions the designation "inert" would be a misnomer. The authors conclude that in the case of a jet of air issuing into air of the same density, the volume of air entrained is strictly proportional to the actual density of the gas.

Other curves refer to hydrogen and carbon dioxide issuing into air at the same temperature. The air entrained by the hydrogen is greater than the value to be anticipated on the assumption that the volume of entrained air is proportional to the density of the gas. The air entrained by carbon dioxide, on the other hand, is less than such an assumption would warrant.

AN INTERESTING THEORY.

These results are explained by the authors in the following way. A jet of gas issuing into air or other gaseous medium is differentiated from a liquid jet issuing into a liquid or gas in that, while in the latter case the surface of the jet is well defined, and the properties of the jet determined very largely by surface tension and density considerations, in the case of the gas jet forces due to surface tension are absent. Moreover, considerations of the respective densities of the issuing gas and of the medium are of increased importance, owing to the possibility of a process of diffusion occurring at the surface of the gas jet. If these densities be equal, such diffusion will be absent, but an analogous effect is produced by a process of interchange between the jet and the surrounding medium.

Consider the case of a gas of density p_1 issuing into a gas of different density p_2, at any pressure. Let a fraction β of each unit volume discharged diffuse into the surrounding medium. Consider a volume V of gas discharged in the jet. A volume β V of this gas diffuses into the surrounding gas, and likewise a volume $\beta \text{ V } \sqrt{\frac{p_1}{p_2}}$ of the surrounding gas diffuses into the jet. This diffusion process will continue until a state of equal densities is attained in the jet and the surrounding medium. The volume of gas in the jet becomes $\text{V} - \beta \text{ V} + \beta \text{ V } \sqrt{\frac{p_1}{p_2}}$, and the mass is $(\text{V} - \beta \text{ V})\, p_1 + \beta \text{ V } \sqrt{p_1 p_2}$. The effective density of the gas is therefore

$$\frac{[\text{V} - \beta \text{V})\, p_1 + \beta \text{ V } \sqrt{p_1 p_2}]}{\left(\text{V} - \beta \text{V} + p \text{ V } \sqrt{\frac{p_1}{p_2}}\right)}$$

Expanding as far as the first power of β, this expression gives for the effective density of the jet the value:

$$\frac{p_1 + \beta (p_2 - p_1)}{\left(\frac{p_1}{p_2}\right)^{\frac{1}{2}}}$$

The result of a process of the nature of diffusion is to increase the effective density of the jet when the jet issues into a medium of higher density, and to reduce the effective density when the jet issues into a lighter medium. In the equilibrium state the jet issues into a medium of equal density; and as under these conditions the degree of aeration is strictly proportional to the density of the gas in the jet, the increased degree of air entrainment due to diffusion is given by $\alpha \beta (p_2 - p_1) \left(\frac{p_1}{p_2}\right)^{\frac{1}{2}}$, where α is a constant. For values of the density of the gas into which the jet issues greater than that of the issuing gas, values of the aeration calculated by means of this formula are in close agreement with experimental values. Where the issuing gas is heavier than that into which it issues, the formula affords results lower than those furnished by experimental data. In this case the corresponding relation for V takes the form $\text{V} = \alpha [p_1 - (\beta p_1 p_2 + \text{C})]$, where C is an additional constant. In agreement with the experimental results, the formula $\text{V} = \alpha \left[p_1 + \beta (p_2 - p_1) \left(\frac{p_1}{p_2}\right)^{\frac{1}{2}}\right]$ indicates that air entrainment due to diffusion is a maximum when the density of the issuing gas is one-third of that into which it issues.

SOCIETY OF BRITISH GAS INDUSTRIES.

Opening of New Offices.

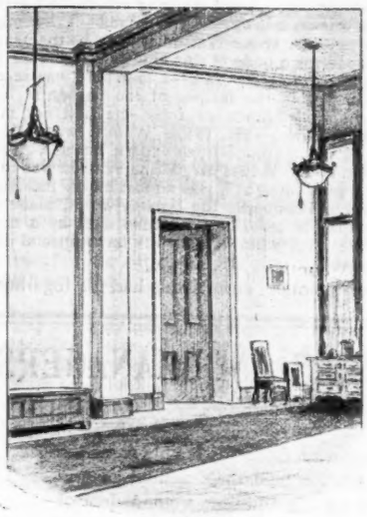
The opening of the new offices of the Society at No. 56, Victoria Street, S.W., on Tuesday, Nov. 27, was a pleasant and informal affair. It was anticipated that the President (Lord Weir) would perform the opening ceremony, but he was unable to do so, and his place was taken by Lord RIDDELL. Letters of regret for absence had been received from Sir Dugald Clerk, Prof. Harold B. Dixon, and Sir Arthur Duckham, all Past-Presidents, Mr. H. Wade Deacon, President of the "B.C.G.A.," and from a number of Past-Chairmen of the Council of the Society; but among those present were Mr. D. Milne Watson (President of the National Gas Council and President-Elect of the Society), Prof. A. Smithells, Mr. F. W. Goodenough, Mr. W. E. Price, Mr. Samuel Cutler, Mr. Cyril G. Davis, Mr. C. S. Bennett, Mr. H. M. Thornton, Mr. A. Cliff, Mr. F. J. Gould, and Mr. Philip Sugg. The offices comprise a suite of rooms on the first floor, facing Victoria Street. The accommodation comprises a spacious council chamber, 29 ft. in length by 15 ft. wide by 13 ft. high, with windows reaching from floor to ceiling. The second room is of the same height and width, with a length of 21 ft. 9 in., and will serve as a general meeting room for members. The secretarial work will be carried on here or in the council chamber, according to occupancy of either of these rooms for other purposes. The third room, of somewhat similar dimensions, will be at the disposal of any member of the Society, for making appointments for any business purpose, private conferences, or for his own convenience in writing. All the rooms open on to a central lobby; and private lavatories and cloak room are installed. It should be further mentioned that the aim of the Council is to arrange the rooms, and especially the council chamber, in such a manner as to command a ready sub-letting for council meetings of other associations, or for similar purposes.

After an informal reception, Lord RIDDELL received the key of the council room, and unlocked the door.

Lord RIDDELL said it gave him great pleasure to open the new offices of the Society. It was always a pleasure to go into a new house; and, judging from the appearance of the rooms, he gathered that the Society were in a state of exuberant prosperity. In these hard times he had rarely seen any new premises which had been so tastefully decorated. He was able to say what useful functions the Society were performing, because he had attended many of their meetings, and meetings of bodies connected with them. The result was that he had gradually added to his knowledge, in addition to making many pleasant friendships and obtaining "copy" for numerous articles dealing directly and indirectly with the gas industry. When he entered the room he was struck very much by the intensity and beauty of the lighting. There was no difficulty, either, in finding the offices from the outside, for they were so brilliantly illuminated. The same remark applied to the adjoining streets. Everyone who had seen the lighting of Victoria Street and Whitehall must admit that gas as a lighting medium—at any rate for outside lighting—stood second to no other. He did not believe there were any better lighted streets in the world than Victoria Street and Whitehall. Without further comment, he said he had the greatest pleasure in declaring the new offices open, and at the same time wished the Society continued success and prosperity. A good deal was heard about the decadence of British trade, and he was not going to say anything about free trade or tariff reform; but in any system of trade the main factor must be the intelligence, enterprise, and energy of those who carried it on. Many critics of British trade and British commercial men and British industrialists would revise their opinions if they had had the oportunity, as he had, of attending the meetings of bodies such as the Society of British Gas Industries. It was only necessary to get into touch with those actively engaged in carrying on the industries and commerce of this country to see how intelligent, enterprising, and energetic they were. The members of the Society of British Gas Industries—if he might say so without being charged with paying them a compliment—stood second to none in this respect.

Mr. CHARLES CLARE (Messrs. Fletcher, Russell, & Co., Ltd.) proposed a vote of thanks to Lord Riddell for opening the offices, and extended a welcome to those present. The first four years of the Society, from 1906 to 1910, had been very awkward ones indeed, and many difficulties had to be overcome. Happily these had been overcome; and he was extremely pleased that the Society now had more suitable offices. He then asked Mr. Milne Watson, the President-Elect, to second the vote of thanks.

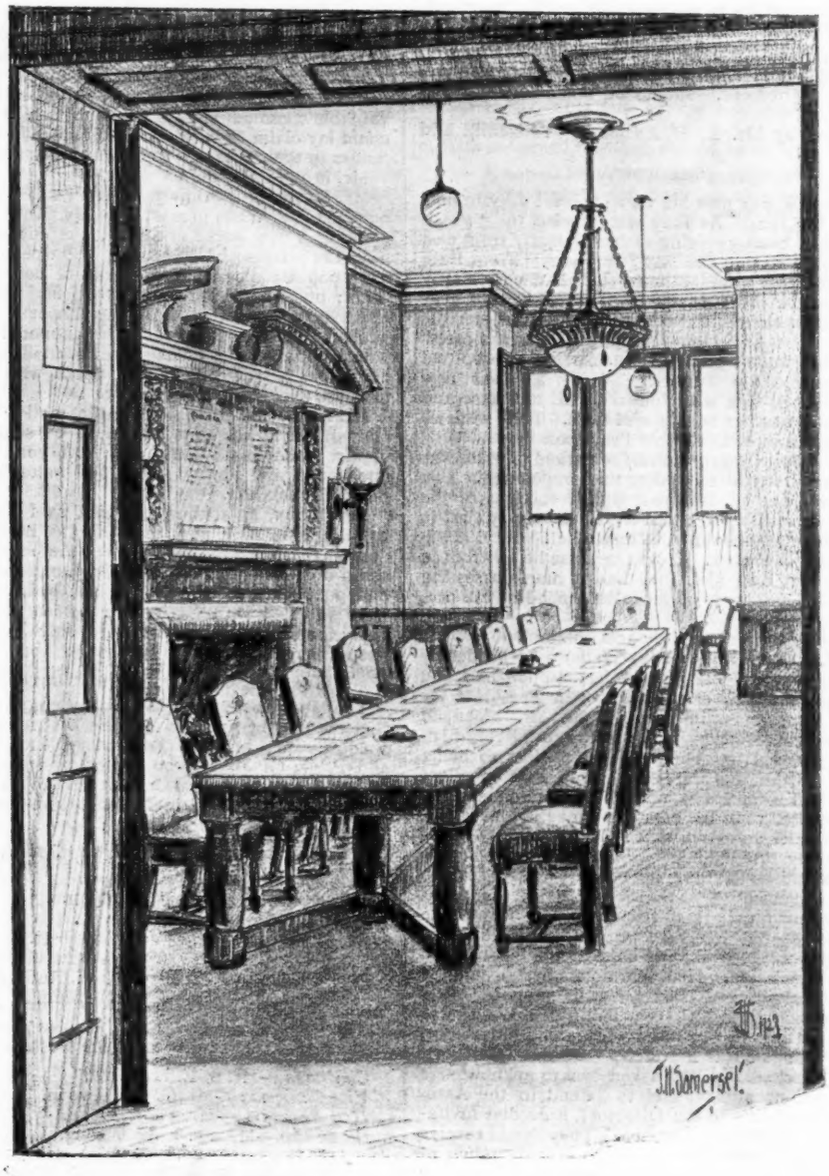
Mr. MILNE WATSON said it was a great pleasure to him to second the vote of thanks to Lord Riddell. It was good of him to spare



The Entrance Hall.

Headquarters of the SOCIETY OF BRITISH GAS INDUSTRIES.

The Secretary's Office.



The Council Chamber.

a little time out of his busy day to come there. Those who had enjoyed the results of the activities of the Society realized that it was doing most important work, and, he believed, was doing it well. It would be difficult for him, as the new President, to follow such distinguished men as those whose names were inscribed in that room; but he would at least do his best to fill the position as assiduously as his predecessors.

Mr. F. C. TILLEY, in supporting the vote of thanks to Lord Riddell, expressed regret at the absence of the President, Lord Weir, and also Sir Robert Hadfield, their Past-President. The Council were proud of the new offices, and felt that a step had now been taken which ought to have been taken a long time ago. The credit was really due to Mr. Cutler for having pioneered this scheme. Mr. Cutler had been the guiding spirit; and, though the company present that day were few in numbers, the Council were extremely grateful to Lord Riddell for having come to open the offices.

Lord RIDDELL, acknowledging the vote of thanks, said he wished to congratulate the Society on their Secretary. When he was President he knew nothing whatever about the duties, and had had a special opportunity of ascertaining what an extraordinarily able person the Secretary of the Society was. Another thing which had given him special gratification was to know that his friend—if he might be allowed to call him so—Mr. Milne Watson, was to be the next President. It was very good for a body of this kind that it should have as its President—occasionally, at any rate—a man who was recognized all over the world as one of the leaders of the particular industry. Whether it was in America, France, or Italy—he had not made inquiries in any other countries—Mr. Milne Watson was well known and recognized not only as a great British expert, but as a great world expert on gas. When he heard that Mr. Milne Watson was to be the next President, he at once thought it was a most happy incident. He believed that under his Presidency the Society would make a great bound forward, because it would be presided over by a man who understood its activities, and who would thus have special facilities for giving effect to them.

Before separating members and friends had tea together.

SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

ANNUAL GENERAL MEETING.

THERE was—particularly in view of the foggy weather—an extremely good attendance of members at the Charing Cross Hotel, on Tuesday afternoon of last week, when the Association held their annual general meeting. The two papers submitted were both well discussed; and there was, in addition, a good deal of business of a formal character to be transacted. The proceedings were presided over by Mr. PERCY S. HOYTE, of Plymouth, who thus brought his period of office—so far as meetings of the members are concerned—to a highly successful conclusion.

CONFIRMATION OF MINUTES.

As soon as the members had taken their seats,

The PRESIDENT suggested that the minutes of the last meeting, as published in the "JOURNAL," should be taken as read and confirmed.

This was seconded by Mr. A. H. ANDREWS (Vauxhall), and agreed to.

THE NEW PRESIDENT.

The PRESIDENT said it was now his very pleasant duty to propose the President for 1924. As they were aware, the "Presidential pendulum" had been swinging rather violently from east to west and back again during the last few years. From Bath they went to Margate, and from Margate they had very nearly got to Land's End, in the town he represented; while next year it was to be, if he might say so, one of their own people—for the majority of those in the Association were Eastern District members. It was with the greatest possible pleasure that he proposed Mr. Leonard J. Langford, of Tunbridge Wells, as their new President. Mr. Langford was well known to all of them, and he was not only known but thoroughly well liked. They were all certain he would make a most admirable President.

Mr. PHILIP G. G. MOON (Bournemouth) remarked that he was glad to have the opportunity of seconding this proposition. The gas industry now was one of the great public services of the country. Its curve was still rising; and it was necessary that to represent this industry they should have men of efficiency, integrity, and high personal character. It was because he felt that in the President-Elect, Mr. Langford, they had a man possessing these qualities, that he had great pleasure in seconding the proposal.

The resolution having been carried by acclamation,

Mr. LEONARD J. LANGFORD (Tunbridge Wells) said he deeply felt the great honour they had that day conferred upon him and the Company he represented, in electing him their President for the coming year. Mr. Hoyte, in moving, and Mr. Moon, in seconding, made kindly references to his ability to fill this high office; but, though grateful to them, he must confess to being fearfully tremulous at the moment. They had seen excellent Presidents occupy the chair, and under their guidance had witnessed with pleasure, year by year, an amazing growth of the Association's activities and usefulness. To follow these stalwarts, he was extremely proud, though profoundly conscious of his limitations. It would be anything but an easy matter to take the reins from their esteemed and able President, Mr. Hoyte—a strong man, a manly man, and a kindly man of wide knowledge and experience, who, despite his huge responsibilities, had devoted himself wholeheartedly, and with conspicuous success, to the interests of the Association. He would do his best to emulate Mr. Hoyte, and earnestly asked their generous support. This was the second occasion on which the Tunbridge Wells Gas Company had received this honour, as in 1892, his predecessor, the late Mr. Andrew Dougall, was President. His Chairman (Mr. Harold A. Beeching) particularly had asked him to acknowledge the tribute paid to the Company, and to extend to the Association, on his behalf and that of the Directors, a cordial invitation to visit Tunbridge Wells in the spring. They would receive a hearty welcome; and if the works failed to provide much of interest, he could assure the members that Tunbridge Wells was a town with lovely surrounding country, well worth seeing.

THE VICE-PRESIDENT.

Mr. LANGFORD said he now had the honour and very great pleasure of proposing Mr. Philip G. G. Moon, of Bournemouth, as Vice-President of the Association. They were all familar with his excellent qualities as an engineer and administrator, while the Company he represented held a great reputation throughout the industry as one always to the fore in modern methods of manufacture and distribution, and in popularizing the uses of their valuable commodities. He thought the Bournemouth Company could lay claim to the noteworthy achievement that every householder in their area of supply was a gas consumer.

Mr. MOON: Not quite.

Mr. LANGFORD: Almost, at any rate. Continuing, he said he believed that at the present time Mr. Moon was busily engaged in erecting a new works, which, in due course, they would hope to have the privilege of inspecting. Bournemouth, one of England's most popular seaside resorts, had of necessity numerous attractions; but he was sure they would find them of very secondary interest to that created by the inspection of Mr. Moon's new works. He personally would be delighted to have Mr. Moon's valuable assistance during his Presidential year, and the Association as a whole would anticipate with pleasure Mr. Moon's ultimate succession to the chair.

Mr. ANDREWS, in seconding the motion (which was cordially passed), remarked that little need be said of the qualifications of Mr. Moon to fill the office. Everyone would agree that his knowledge and ability would add materially to the usefulness of the Association.

Mr. MOON, in acknowledgment, said he was sensible of the honour done him, and, in so far as he could, would try adequately to uphold the traditions of the position. He was sorry he could not absolutely confirm Mr. Langford in the suggestion he had put forward—that all the houses in the Bournemouth area were supplied with gas. The percentage, however, was very high; for he believed there were only about 200 out of 27,000 not so supplied.

GENERAL COMMITTEE AND DISTRICT COMMITTEES.

The HON. SECRETARY (Mr. W. H. Bennett, of Redhill) announced that the members of the Eastern District had elected Messrs. C. Valon Bennett and J. S. Thorman (to succeed Messrs. H. C. Head and P. G. G. Moon, who retired by rotation) as representative members on the General Committee. With regard to the Western District, no representatives retired from the General Committee. He also reported the following:

Committee and Officers of the Eastern District for 1924.

Chairman.—Mr. A. H. Andrews.
Vice-Chairman.—Mr. F. Smallbone.
Hon. Secretary.—Mr. L. Trewby.
Committee.—Messrs. C. Valon Bennett, C. F. Botley, A. Caddick, Chas. Chambers, Alec. G. Cheal, J. Fisher, D. H. Helps, S. Lacey, W. E. Price, R. H. Ruthven, C. H. Rutter, H. C. Smith, J. Terrace, J. S. Thorman, J. F. Tyndall, W. H. Warren.

Committee and Officers of the Western District for 1924.

Chairman.—Mr. S. E. Halliwell.
Vice-Chairman.—Mr. C. G. Dawson.
Hon. Secretary.—Mr. W. E. Dean.
Committee.—Messrs. J. Armstrong, J. H. Cornish, P. S. Hoyte, J. Harger Pye, H. E. Riley, R. Robertson, W. P. Tervet, J. Taylor, E. P. Vince, and J. Wesley Whimster.

AUDITORS AND HON. SECRETARY.

Mr. H. GAGE (Sutton) proposed, Mr. R. H. RUTHVEN (Ramsgate) seconded, and it was agreed, that Messrs James Donaldson and John Urquhart be re-appointed Auditors.

The PRESIDENT said he would now propose the re-election of the Hon. Secretary. Presidents came and Presidents went. He did not say their Hon. Secretary was prepared to go on for ever; but he was a fortunate President who had Mr. Bennett as Hon. Secretary to assist him. There was, in fact, no harder-working Secretary to be found in any district; and he had not only their respect, but their affection also. It was the fervent wish of all of them that his health might stand the continued strain of office.

Mr. LANGFORD said some time ago it appeared that Mr. Bennett might have to resign his office, for reasons of health; but they were delighted to find that he could see his way to continue the arduous duties associated with the position of Secretary. He had pleasure in seconding Mr. Bennett's re-election, for no one could better carry out the duties of Secretary.

The resolution was cordially agreed to, and acknowledged by Mr. BENNETT, who expressed his appreciation of the kind things that had been said.

NEW MEMBERS.

The PRESIDENT said he was happy to be able to tell them that there were the names of no fewer than seven new members to be submitted. They were gradually getting on to the 300 mark which had so long been looked forward to.

On the proposition of the PRESIDENT, seconded by Mr. A. CADDICK (Croydon), the following new members were then elected: Mr. John Alexander Gould, London; Mr. Harry Morris, Gas Offices, Jersey; Mr. Thomas Karslakey Ponsford, Gas-Works, Wiveliscombe, Som.; Mr. Frank Calvert Robinson, Bankside, Sculcoates, Hull; Mr. Frederick John Robinson, Gas-Works, Chesham, Bucks.; Mr. William Walter Townsend, Gas-Works, Colchester; and Mr. Arthur Wells, Gas-Works, Milton Regis, Kent.

ALTERATIONS OF RULES.

The PRESIDENT next proposed alterations of, and additions to, the rules which had been circulated among the members. He explained that the Committee had spent a good deal of time over them; but nevertheless they would be glad to hear any comments members might like to make. The main alteration was necessitated by compliance with the request of the Junior Associations for affiliation. The power sought was:

> The General Committee may, on behalf of the Association, grant affiliation to Junior Gas Associations whose members are drawn from the South and West of England, and the General Committee may revoke such affiliation. Such Junior Associations shall, during affiliation, have the power to nominate their President and Hon. Secretary for the time being as members of the General Committee, but without power of voting.

He thought one of the most pleasing features of the industry was the increasing strength of these Junior Associations. They were composed of the men who would follow on; and it was gratifying to read in the Technical Press the excellent, and increasingly valuable, papers contributed to the proceedings of these Junior Associations. He felt sure the proposal for affiliation would commend itself to all present.

Mr. SAMUEL GLOVER (St. Helens): You are proposing to put the Southern Association on the same lines as the other District Associations.

The PRESIDENT: We are not behind-hand in many things; but perhaps we have been in this, and we hope to rectify that to-day.

Mr. GLOVER: I did not mean it in any way censoriously.

The PRESIDENT said the next alteration proposed was:

> 4.—The annual general meeting shall be held in March, and there shall be at least two other general meetings held during the year; the places of such meetings to be determined from time to time by the members in general meeting.

A point was then raised as to the November meeting; and it was agreed, on the proposition of Mr. J. R. H. JACOBS (Southampton), seconded by Mr. G. W. ANDERSON, to add to this altered rule, after the word "year," "one of which shall be in November."

> 6.—The President, Vice-President, Hon. Secretary and Hon. Treasurer shall be elected annually at the general meeting in November, and they shall take office on Jan. 1 following for the ensuing twelve months.
>
> 7.—The management of the Association shall be vested in a General Committee consisting of the President, Vice-President, the last three Past-Presidents, an Hon. Secretary, an Hon. Treasurer, together with the District Chairmen and Secretaries *ex officio*, and District Representatives to be elected for a period of three years by the members in their respective districts. Five to form a quorum.
>
> 8.—The District Representatives on the General Committee shall be elected by members in their respective districts each year at a meeting to be held prior to the general meeting in November at the rate of one representative for every 25 members in each district, provided that each district shall be entitled to elect not less than two members. Any representative having served a full term of three consecutive years shall be ineligible for re-election for the year following. The District Committees shall have power to fill casual vacancies.
>
> 9.—The members in each district shall appoint annually at the meeting mentioned in Rule 8 a Chairman, Vice-Chairman, Hon. Secretary and Committee for the district, and they shall take office on Jan. 1 following for the ensuing twelve months. The President, Vice-President, Hon. Secretary, and Hon. Treasurer of the Association shall be members *ex officio* of the District Committees.

On the motion of the PRESIDENT, seconded by Mr. L. TREWBY (Mill Hill), the rules as amended were adopted.

PAPERS AND DISCUSSIONS.

The next business on the agenda was the reading and discussion of the following two papers:

"Waste Heat and its Insulation from Glover-West Verticals and other Carbonizing Plant," by Mr. J. S. Thorman, of the Gas Light and Coke Company, London.

"Some Aspects of Distribution," by Mr. Samuel B. Chandler, A.M.I.Mech.E., of the Tottenham District Light, Heat, and Power Company.

For Mr. Thorman's paper and discussion, readers are referred to pp. 577 81 of last week's issue and to p. 644 respectively.

Mr. Chandler's paper and the discussion on it, will be found on p. 652.

MR. THORMAN'S ILLNESS.

The PRESIDENT, on reaching this portion of the proceedings, said he had an announcement to make which they would all receive with the greatest regret. Mr. Thorman about a fortnight ago was taken very seriously ill. He had to enter a nursing home, and for some days was in the greatest danger. Happily, however, the latest news was that he was rapidly recovering. From correspondence he had seen which was written before the operation, it seemed that Mr. Thorman was thinking very much more about his paper than he was about his illness; and this was not surprising, for the contribution was a remarkable one. Of course, it was utterly impossible for him to be at the meeting to read the paper, but Mr. Thorman was very anxious that it should not be passed over without being read. Mr. Langford had consented to do this.

Mr. LANGFORD remarked that as a personal friend of the author, he would like to associate himself with what the President had said. They all knew the great interest Mr. Thorman took, not only in the Association itself, but in the Eastern Section meetings. His absence that day was much regretted.

The PRESIDENT, at the conclusion of the discussion on the paper, said he was sure the members would desire to send a telegram to Mr. Thorman, saying how much they had appreciated his paper.

It was agreed that this should be in the following terms:

> Members of the Southern Association send best wishes for your speedy recovery, and thank you very heartily for your original and intensely interesting paper, enthusiastically received. — Hoyte, President.

THE EDUCATION SCHEME.

The PRESIDENT drew attention to the fact that a further appeal had been received from the Institution of Gas Engineers to members to support the education scheme for the industry. Of course, everyone was not in a position to forward this work, but those who could he was sure would do their best.

THE LATE MR. WEBBER.

The PRESIDENT said he was very sorry to have to close the business on a note of sadness. Mr. Webber, who had been associated with the industry for many years, passed away last week. He was a friend of every one of them, whom even the oldest of them could remember almost from boyhood. He would ask the members to rise silently in their places, and the Secretary to forward to the family this vote of condolence.

A PRESIDENT'S MEDAL.

Mr. TREWBY announced that he had been asked by the Committee to put forward a resolution of which they approved. It was to the effect that the Association should institute a medal or other memento, to give to their retiring Presidents.

Mr. ARTHUR VALON seconded the proposition, declaring that it was an excellent idea which should have been adopted years ago.

The members unanimously agreed.

THE PRESIDENT THANKED.

Mr. R. ROBERTSON proposed a very hearty vote of thanks to the President for his conduct of the meeting that day. Mr. Hoyte had most worthily maintained the high standard set by his predecessors.

Mr. J. TERRACE (Lower Sydenham) seconded the proposal, which met with unanimous approval.

The PRESIDENT said he must take this opportunity of telling them what an extremely pleasant year of office he had had. He had not only cemented a good many old friendships, but had been able to form some new ones.

The members before separating took tea together.

London and Southern District Junior Association. — Friday evening, Dec. 14, at 7.30, at the Westminster Technical Institute, is to be a "short paper" meeting, at which three subjects connected with the distribution of gas will be discussed. The authors and titles of the papers are: "Notes on Domestic Hot-Water Supply," by Mr. S. B. Chandler, of the Tottenham District Light, Heat and Power Company; "Notes on Waste in the Distribution Department," by Mr. E. L. Oughton, of the South Suburban Gas Company; and "Gas Sales and Builders' Business," by Mr. W. L. Westbrook, of the North Middlesex Gas Company.

WASTE HEAT AND ITS INSULATION FROM GLOVER-WEST VERTICALS AND OTHER CARBONIZING PLANT.

A paper on this subject, by Mr. J. S. THORMAN, of the Gas Light and Coke Company, was presented at the meeting of the Southern Association yesterday week [see p. 642]. The text of the paper and the majority of the photographs were published in last week's "JOURNAL," pp. 577-81, and the following is our report of the discussion.

The PRESIDENT (Mr. Percy S. Hoyte, of Plymouth) said that the Southern Association had always been able, fortunately, to maintain a very high standard in the papers that were submitted at the meetings; but he ventured to say that few, if any, more remarkable or original communications than this had been placed before them—at any rate within his recollection. The paper to which they had just listened was characteristic of the man who prepared it, who was unhappily not with them, owing to the serious attack of illness to which he (the President) had made reference. The paper's characteristic seemed to be the thoroughness of the scientific method by which Mr. Thorman dealt with the problems confronting him. The figures upon which he based his calculations were most carefully gone into; and they could congratulate Mr. Thorman from the bottom of their hearts upon the fact that these figures were based on a conservative estimate. They had not only been attained, but very far exceeded. The results he had secured with his waste-heat boilers were as good as the performance of an average Lancashire boiler. He believed the results attained would form the beginning of a new era for the industry in respect of waste-heat recovery. He had referred before to the nightmare that it was to a gas engineer to think of the millions of heat units that were passing away "into the blue" from the retort-house stacks—whether a horizontal or vertical house. Mr. Sheridan (Mr. Thorman's Assistant) and Mr. Cheeseman (his Chemist) were, he was happy to say, present, and would reply to any points that might be raised. Perhaps Mr. Hardie would be good enough to open the discussion, as it was with his permission that the paper had been read and Mr. Thorman had had the material for preparing it.

GROWING IMPORTANCE OF WASTE HEAT.

Mr. T. HARDIE (Gas Light and Coke Company) remarked that it was rather a difficult thing to open a discussion on this paper, but he was glad of the opportunity of expressing his appreciation of the very excellent communication that Mr. Thorman had put before them. As the President had said, the author had gone into this matter with his usual thoroughness. The question of waste heat, of course, had been before engineers for a very long time. Waste heat going to the chimneys from the retort-house, he thought, had been recovered many years ago—longer than he could remember—but it was only recently that it had come so much into prominence, owing to the higher temperatures at which the gases were to-day leaving the retort-house chimney, in the case of both vertical and horizontal retorts. With these higher temperatures, the waste was very serious; and he had no doubt the calculations set forth in the paper would be attained under conditions such as had been stated. It was scarcely credible that they should recover as much as 5 lbs. of steam for every pound of fuel used in the producers. In fact, it made one think they were getting the heating of their settings done for almost nothing. It was a matter of great regret to Mr. Thorman—as it was to them all—that he was not able to be present to read the paper; but they were glad to know he was making a good recovery. He hoped they would soon have him back at work among them once more. ["Hear, hear."]

EXPERIENCE AT TOTTENHAM.

Mr. J. FISHER (Tottenham) remarked that Mr. Thorman had given them a most interesting paper, and they must congratulate him on the fact that the results obtained under test exceeded the estimates. Where a considerable amount of heat at a moderately high temperature was unavoidably being wasted, some form of heat recovery must be an economical proposition; but, in his opinion, the word "unavoidable" should be stressed. At present the high temperature of the waste gases leaving a setting of vertical retorts seemed unavoidable; and to use this heat for steam raising was obviously economical in theory, and this was borne out in practice. At Tottenham, two waste-heat boilers had been installed in connection with the Woodall-Duckham vertical retorts. The total cost of the installation was £6877. Taking interest, depreciation, and repairs at the generous figure of 21½ p.ct. a year, the annual capital charge amounted to £1479. The fuel saved was 90 tons per week, which, at £1 per ton (the same figure as Mr. Thorman had taken), amounted to £4580 per annum. This was a net saving of £3100 a year; so that the total cost of the boilers and settings would be repaid in a little over two years. The installation at Tottenham consisted of two Babcock and Wilcox boilers, each having 1959 sq. ft. of heating surface, and fitted with superheaters. The feed water was preheated in Green's economizers, each having 508 sq. ft. of heating surface. The waste gas entered at a temperature of 430° C., which was considerably less than the 689° C. given by the author; but in the case of Tottenham, when the tests were being made, there was considerable infiltration of air, which was afterwards remedied. In passing through the boiler and economizer, the temperature was reduced to 125° C.—showing the advantage of the economizer. An induced draught fan was used in connection with each boiler; each taking about 13 B.H.P. The feed water was supplied from the overflow of the water jackets of the outside producers at a temperature of 53° C., and left the economizer at 110° C. Each boiler produced 4000 lbs. of steam per hour, at 120 lbs. pressure and 88° Fahr. superheat. The boilers were intended to deal with the waste gas from two benches of seven settings of Woodall-Duckham vertical retorts carbonizing 300 tons per day; but at the time when the tests were made, only half the number of retorts was at work, and the particular bench was the farthest away from the boilers. A comparison of the steam raised per pound of fuel used in the producers was, in these circumstances, hardly fair—particularly as outside producers used more fuel per ton carbonized than producers built in the settings. A considerable amount of steam was also used with them to saturate the air, and this steam was rejected at a high temperature. The result in their case, however, was 2·86 lbs. of steam per pound of fuel used, containing 5 p.ct. moisture. Reverting to the paper, did not Mr. Thorman put the temperature of his waste gas unduly high? At Tottenham, with a different type of retort, the temperature in the main flue of the verticals was not more than 670° C. Again, with horizontal retorts and good regenerators, it had always been the aim of gas engineers to get a nearly black flue—say, 500° C., not the 750° given by the author. With waste gas at the lower temperature a much larger and more expensive boiler plant would be required; and he was not sure that it would pay. It was, however, possible that the author was right in assuming that the most economical method of working was to waste a little heat in the exit gas and recover it as steam in a very efficient boiler, rather than waste the minimum of heat in the exit gas and have to generate steam from coke or breeze in a less efficient boiler. He hardly thought the author was right in putting the efficiency of boilers in a modern works as low as 50 p.ct.; and, lastly, if in the ordinary boiler practice in gas-works 5 lbs. of steam was raised per pound of fuel—and he agreed with this—it seemed, as had already been remarked, almost extraordinary that 5·36 lbs. could be raised per pound used in the producers after the retort settings had been heated by means of this same fuel.

Mr. J. W. WHIMSTER (Bath) said he agreed that those who were working horizontals with low temperatures did not get such a temperature in the gases as that stated by Mr. Thorman, and therefore a waste-heat boiler would not appear to be economical; but he could well imagine that with higher temperatures and silica retorts such a state of affairs might arise. Was this due to the fact of the present regenerator being adapted to suit existing working, but when they came to silica retorts the regenerator was not large enough? Had Mr. Thorman gone into the figures to ascertain whether it was more economical to recover the heat in the regenerator or in the waste-heat boiler? If in the waste-heat boiler, why have regenerators? This was a point well worth going into, because it would not only mean the elimination of one method of recovering heat, but it would result in a considerable saving in the construction of a retort-house by doing away with the regenerators.

Mr. FRANK LIVESEY (Maidstone) said reference had been made to 5·36 lbs. of steam at 113 lbs. pressure per pound of fuel used in the producers; and the point had been raised that this was extraordinarily high as compared with ordinary gas-works practice with Lancashire boilers; but consideration in this case must be given to the fact that the temperature of the feed water was extremely high. It was stated in the paper that the feed water was heated to 170° Fahr. by exhaust steam from the gas pumping station. This made a good deal of difference. With regard to the efficiency of the boiler, he agreed that the tube efficiency of the boilers as such was 90·3 p.ct.; but if they considered the efficiency of the whole apparatus—that was, the flue and the waste-heat boiler as well—they must take into account the amount of fuel used to provide the 36 H.P. for the two fans. The paper was a striking one, and showed what an extraordinarily inefficient device the ordinary chimney stack was to promote draught. One thing not quite clear to him was the capital charges, which, at 5 p.ct., amounted to 1·2d. per ton. Was this reckoned at per ton of coal carbonized during the period when the setting was at work, or per annum, because under the best arrangement possible, the boilers must be out of operation for a considerable time?

Mr. SHERIDAN: Per annum.

CARBONIZATION PRACTICALLY FOR NOTHING.

Dr. R. LESSING (London) said there was one point he would like to bring out. The paper showed how inefficiently the heating proposition in a gas-works had been carried out in the past. It had been remarked that it almost seemed as if they were to get carbonization done for nothing. He would like to put forward the point of view of the theoretical man, which was that they ought to get carbonization for nothing, except for radiation losses, and so on. As most of those present would be aware, a great deal of investigation had been carried on to ascertain whether heat was absorbed or evolved in the carbonization process—that was to say, whether it was endothermic or exothermic. But, whichever way it worked, one thing was certain—it was practically on a level. If any heat should be required, it was almost negligible. So they came to the point that carbonizing ought to be done, apart from radiation losses and the heating-up of the setting, without expenditure of heat. Still, even theoretically this could not be so, because coal had to be raised to the temperature at which the reaction would proceed without the expenditure of further heat. This heat must be put into the process; and that was really the heat which ought to be again available for recovery. So if they looked at the matter from this point of view, there ought to be a very great amount of heat recoverable from the process. This should be not only a theoretical, but a practical, proposition; and he had not the slightest doubt that much progress would be made in this direction. If early attempts at heat recovery—and they were really only at the beginning of things—produced these striking results, they were justified in anticipating that in a few years they would do much better, and come somewhere nearer theoretical possibilities. The first waste-heat boiler he saw was about eight years ago in the United States. They actually went then as far as Mr. Fisher had mentioned. They put in a Green's economizer, and discharged the flue gases from quite a considerable works, making 5 million c.ft. a day, through a 9-in. pipe. This works was one of a few he referred to two or three years ago at one of the Institution meetings, when he gave rise to a certain amount of uncalled-for hilarity by stating that in these works they had actually to provide steam-heated radiators to keep the stokers warm in the severe climate of the United States. It was by no means a joke; and some of those present would no doubt remember seeing the photographs he then had of the works. He mentioned it again, because the question of heat insulation had been brought out so re-

markably in the paper. If this could be applied with such success to the conserving of heat in the waste gases, the same principle might be applied to the settings themselves, and obviate a considerable amount of radiation there. The paper must have an immense practical bearing upon the progress of carbonizing practice.

Mr. T. CARMICHAEL (Portsmouth) remarked that two waste-heat boilers were being installed at the works of the Portsea Island Gas Company. In fact, one had just been put into operation, and the second would be at work within the next few weeks. The boilers he referred to were both for verticals; and in place of the electrical drive for the fan, they had a high-speed steam-engine. The paper contained a vast amount of information which would be of great interest to them at Portsmouth.

Mr. F. G. GORMAN (Lower Sydenham) said the author mentioned that the softening of the water cost about 1d. per 1000 gallons. Did this include capital charges and maintenance costs? It was also stated that the plant reduced the hardness to zero. Had the author experienced any difficulty from pitting of the boilers in consequence of this softening process? From how many degrees of hardness, temporary or permanent, was the water reduced? Mr. Thorman mentioned 750° as the temperature of the waste gases in the chimney; but it seemed to him that this was a little too high. His Company endeavoured to maintain—and he believed they succeeded in maintaining—about 600° C. for their chimney gases, with 16½ or 17 p.c. CO_2. If they could sufficiently reduce the temperature of the waste gases, this must be more economical than putting down waste-heat boilers.

Mr. E. G. STEWART (Fulham) pointed out that two years ago he himself had read a paper on this very subject at the Engineering Conference of the Institution of Civil Engineers, and that he gave some figures then showing what heat could be recovered under the same conditions as Mr. Thorman had mentioned with gases at a much lower temperature. At (say) 500° C. it was possible to get a little over 1 lb. of steam per pound of fuel used, or 350 lbs. of steam per ton of coal carbonized.

The PRESIDENT said he would ask Mr. Sheridan and Mr. Cheeseman to reply, as far as they were able offhand, to the points raised.

QUESTIONS ANSWERED.

Mr. SHERIDAN, in the course of his reply, stated that they expected to pay for the whole installation in a year, on the present basis. Wear and tear, boiler fuel, and gas used in engines for generating electricity ran out now to about £10,000 a year; while the installation would cost about £8000. Mr. Thorman had gone very carefully into the question of horizontal regenerator settings, and many experiments had been made, and he (the speaker) thought that he was well justified in his statement that waste gases at 750° C. were available—with a combustion chamber temperature of about 1350° C., and carbonizing at full capacity. He thought it was very hard to get the temperature below that, even with a regenerator. As to whether or not it paid to put in a regenerator, he should say this was a point to be considered at the present time. One point in favour of the regenerator was the higher flame temperature in the combustion chamber, due to having the hot secondary air. Their feed water was heated to 155° on this test; but they got up to 180° at times, with the exhaust steam from the gas pumping station. The "Permutit" plant was near, and consequently they simply took the exhaust steam along, and through a very efficient heater could get the temperature they desired. The question of pitting in boilers by using the "Permutit" plant to zero hardness had been referred to a good deal. They ran the "Permutit" plant for four months on Lancashire boilers. Then they shut a boiler down, and made an internal examination, but failed to find any pitting. Working as they did, he did not anticipate any difficulty with the boilers. The 1d. cost per 1000 gallons for softening the water did not include capital charges, but just the cost of the wash water, blow-down water for boilers (about 500 gallons daily), and salt, which they got from their products works. Obtaining salt as a small company would have to do, the cost might be 2d. per 1000 gallons for water softening.

Mr. CHEESEMAN said the water was of mostly temporary hardness. As to the temperature of the waste gases (900° C.) being rather high, he would point out that in the latest installations of Glover-West verticals the waste gases were at 1050°.

Mr. SHERIDAN remarked that, in making any calculations with waste gases, the CO_2 content was a very important factor. Mr. Thorman laid great stress upon this. It was impossible to take too many samples.

A REMINISCENCE.

The PRESIDENT said they were all extremely indebted to Mr. Sheridan and Mr. Cheeseman for their presence, and for the admirable way in which they had dealt with the various points that had been raised in the discussion. All of them would return home with a lot to think about—particularly in connection with the question of the temperature of waste gases. There was no doubt, if they were going to put in boilers to deal with waste gases at 500°, this would be a very different proposition from installing them with the latest type of Glover-West retort, which gave them waste gases of well over double this figure. Mr. Whimster had raised an extremely interesting point, which he hoped might form the basis of another paper—the question of cutting-out regenerators from horizontal retort houses, when putting in waste-heat boilers. Over thirty years ago, he (the President) was present at the start of what he believed was one of the earliest attempts to recover waste heat in the form of steam, which was made by his late lamented Chief, Mr. W. R. Chester, when at Nottingham. It was quite a miniature affair—a little cylindrical vertical boiler, with pipes dipping down U-shape in the waste flue; but he recovered quite sufficient heat to inject steam into the generators he had put in at Nottingham. Had Mr. Chester only been with them that day, he would have greatly appreciated the work that had since been done on waste heat by men of the calibre of Mr. Thorman.

The Illuminating Engineering Society.—A meeting of the Society is to be held at the Royal Society of Arts on Tuesday, Dec. 11, at eight o'clock, when a discussion on "Some Applications of Illuminating Engineering in Practice," will be opened by Mr. G. Herbert and Mr. R. A. Ives.

PUBLIC WORKS, ROADS, AND TRANSPORT CONGRESS.

In connection with the Exhibition at the Agricultural Hall, which opened on Nov. 22 and closed on Nov. 29 (an account of which was given in last week's "JOURNAL"), a series of conferences on a variety of subjects was held. These individual conferences were organized by institutions concerned with various industries. The Institution of Gas Engineers arranged one last Wednesday, when two papers were read and discussed. There was a large attendance of gas men and road engineers and surveyors.

Mr. S. TAGG, of Preston, President of the Institution of Gas Engineers, was in the chair.

In opening the proceedings, the CHAIRMAN said that on behalf of the Institution of Gas Engineers he wished to say how they welcomed in conference those with whom they had so much in common in regard to the use of roads and the applications of gas. Many of those interested in the Congress as a whole were, of course, responsible for local government. They were either in possession of a gas undertaking of their own, or were in the position of representing consumers, watching their interests, and exercising some control over the operations of the gas undertaking supplying their district. The two papers which were to be submitted had been chosen by the Committee of the Congress. The first was on the quality and composition of town gas, by Mr. H. E. Bloor. He took it that this subject had been selected because of the interest arising out of the altered basis of charge. The genesis of the therm would be dealt with by Mr. Bloor. As was well known, it was the outcome of the Government's desire to effect economy in coal supplies that the Fuel Research Board introduced the therm as the basis of charge.

Mr. BLOOR, in introducing his paper, said he had endeavoured to treat the subject in a manner that would be useful to municipal men who were called upon to deal with matters relating to Gas Orders and Parliamentary Bills.

QUALITY AND COMPOSITION OF TOWN GAS.

By HAROLD E. BLOOR, B.Sc., B.Eng. (Engineer, Secretary, and Manager to the York Gas Company).

[ABSTRACTED.]

A right understanding of the issues involved in a discussion of the quality and composition of town gas demands some acquaintance with the history of statutory control of the industry, and this communication has almost necessarily mainly assumed the form of an historical survey leading up to the passing of the Gas Regution Act, 1920. Quality and composition of gas have relation to price; and there is therefore included some account of legislation affecting prices and dividends, in so far as such legislation has a bearing on the subject of the paper. Municipal undertakings, while in theory subject to statutory control, have always in practice enjoyed comparative freedom; hence references here relate solely to gas companies, and mainly to the Metropolitan Companies, which latter have always been subject to the most stringent supervision known at any period, and have naturally been compelled to fight out in Parliament many questions of principle affecting the interests of gas companies.

EARLY HISTORY.

The first public use of gas for lighting was in 1803, when Winsor lighted the Lyceum Theatre. In January, 1807, he provided a display in Pall Mall, to arouse interest in the new illuminant. In July, 1807, an official trial of gas street lighting took place in Golden Lane and Beech Street, and proved so successful that it was retained as the permanent mode of lighting. The first Gas Company incorporated by Act of Parliament was The Gas Light and Coke Company, with a capital of £200,000. Its first meeting took place in 1812.

Gas was used for many years almost entirely for street lighting, and its general adoption for indoor lighting did not occur for a very long period. The purity of gas was a matter of little moment while its use was confined to street lighting, but became of urgent importance as its use for indoor lighting developed. It was, however, not until 1868 that Parliament passed an Act which, *inter alia*, prohibited the presence of sulphuretted hydrogen in the gas of the Metropolis; and the Gas Works Clauses Act, 1871, made this prohibition general. This Act did not prescribe the minimum quality to be supplied, this being left to be dealt with in individual Acts—no doubt for the reason that the quality of gas which could be economically supplied in any area was affected by local circumstances, and no general law could therefore be universally acceptable. At this period, however, 15 c.p. was generally the quality of gas inserted in Gas Acts, although higher and lower qualities were prescribed in particular Acts. In the Metropolis, the quality was 16 c.p.

SLIDING-SCALE OF DIVIDEND AND PRICE.

In 1866, Parliament, in an Act of the Sheffield Gas Company, tried what is now known as the "Sliding-Scale of Dividend and Price," which after a period of controversy appeared in 1877 in "Standing Orders": "In the case of every such Gas Bill it shall be competent to the Committee so to regulate the price of gas to

be charged to consumers that any reduction of an authorized standard price shall entitle the Company to make a proportionate increase of the authorized dividend, and that any increase above the standard price shall involve a proportionate decrease of dividend." The sliding-scale thus provides a powerful incentive to gas undertakings to use every endeavour to reduce costs by improved methods of manufacture and commercial development. Its effect on the mental processes of professional gas managers was profound; for it entirely removed the possibility of the evolution of a state of satisfaction with the *status quo*, there being clearly no body of proprietors who could fail to hope for even better dividends, however relatively satisfactory the contemporary position might be.

Generally speaking, the increase or decrease of dividend—called the "slide"—corresponding to an alteration of 1d. per 1000 c.ft. in the price of gas, was 5s. p.ct. in respect of 10 p.ct. stock, 3s. 6d. p.ct. on 7 p.ct. stock, and 2s. 6d. p.ct. on 5 p.ct. stock; but these slides were by no means universal, greater and less amounts having been inserted in numerous Acts. There are also cases in which the slides differ in respect of separate blocks of stock in the same company, although the standard dividend may be the same in each case. Standard prices were generally fixed on the basis of costs as revealed in the accounts for the previous few years, and were related to the same quality of gas as contemplated in the new Act. They were in general not amended after having once been fixed, though the practice of Parliament in this respect was not invariable, even before the war.

Where gas companies have applied to Parliament for power to reduce the prescribed candle power, Parliament has in general altered the standard price, the amount of reduction corresponding to 1 c.p. having frequently been 1d. per 1000 c.ft., though there were numerous exceptions.

QUALITY AND TESTING.

The continual shrinkage in the importance of illuminating power, and other causes, led many companies to desire a reduction in the candle power prescribed in their Acts, and the case for lower quality was fought strenuously and successfully against strong opposition on the part of local authorities. In 1900, the matter was carried a definite stage forward by the famous case of the South Metropolitan Gas Company, who secured a reduction from 16 to 14 c.p. with 1d. reduction in standard price for each candle reduction. An interval of four years was required to elapse before the final reduction from 15 to 14 c.p.; and the Company were required to supply consumers free of charge with "burners suitable in all respects for the consumption of gas of the illuminating power prescribed in the Act." This case may be said to have placed it beyond further controversy that some municipal bodies had in this matter taken a view acceptance of which was not in the best interests of consumers of gas.

In 1904 a Departmental Committee of the Board of Trade were appointed to consider and report upon the testing of the gas in London; and though the Committee recommended no change in the method of testing, an agreed Bill was passed into law in the session of 1905, in which it was provided that the burner should be prescribed by the Gas Referees, and that "the burner so prescribed shall be of such a pattern—not being an incandescent or similar burner—as shall be practicable for use by the consumer, and the burner and chimney (if any) shall be the most suitable for obtaining, and in making the test shall be so used as to obtain, from the gas when consumed at the rate of 5 c.ft. an hour the greatest amount of light."

In the session of 1906 a new testing clause was framed by the Parliamentary authorities, and the "Metropolitan" No. 2 Burner, used as indicated above, was under its provisions prescribed in all Acts as from that date until the adoption of the calorific standard. The use of the burner was extended by Special Acts to a large number of companies between 1905 and 1910. The effect of substituting the No. 2 burner was appreciably to increase the apparent candle power of the gas tested; but in general Parliament did not vary standard prices on its adoption. The practice was not, however, quite uniform, for in a Bill before Parliament in the session of 1910 a standard price was reduced by 1d. per 1000 c.ft. as the result of the opposition of the municipality concerned.

THE CALORIFIC STANDARD.

The ultimate justification of the gas industry for the part played by it in the prolonged controversy regarding quality and testing, was the fact that, with the use of the incandescent burner, all natural sanction for an illuminating power basis of appraisement of gas disappeared, and luminosity ceased to be a factor of primary importance. In 1904 the Departmental Committee on Gas Testing in the Metropolis recommended that calorific tests should be made for purposes of information only; and the first official act occurred of a series the logical culmination of which was the passing of the Gas Regulation Act, 1920. In the London Gas Act, 1905, the recommendations of the Committee were carried into effect, and in their Act of 1909 the Gas Light and Coke Company had imposed on them the first calorific standard prescribed by Act of Parliament. It was coupled with the illuminating power test, so that the Company had a dual standard. According to the provisions of the Act, the gas supplied was to be of 125 calories (496 B.Th.U.) net per c.ft.; but no penalty was incurred unless the gas fell below 112·5 calories (446·4 B.Th.U.). The illuminating power of 16 candles imposed by the 1905 Act was reduced to 14 candles, and the standard price was reduced by 1d. per 1000 c.ft.

A dual standard such as that of the Gas Light and Coke Company by no means met the views of the gas industry. It left the old illuminating power standard not merely still in existence, but in the dominating position; the calorific standard being merely an added restriction. In his presidential address to the Institution of Gas Engineers in 1910 the late Mr. James W. Helps, M.Inst.C.E., made a powerful and convincing claim for the abolition of the illuminating power test in favour of a test of heating value. He concluded with a declaration which undoubtedly expressed the views of the entire industry: "The dual standard would have the effect of making it more difficult for gas companies to produce that quality of gas best suited for the use of the public, and of adding appreciably to the cost at which it could be supplied." In 1912 the South Suburban and Wandsworth Companies obtained the first Acts incorporating the principle of the calorific test only. The Companies had previously worked to a standard of 14 c.p.; and under their Acts this was replaced by 540 B.Th.U. gross per c.ft. Succeeding parliamentary sessions saw the new system adopted in many other Acts.

Important though this step was, it still fell far short of the ideals of the gas industry, for it consisted in every case in substituting for a definite candle power a calorific value standard as nearly as possible equal to that of the gas previously supplied under the old standard. It was already known that such calorific powers could be obtained with lower illuminating qualities and at lower cost, and the scope of the manufacturing processes available to the industry was certainly widened, and new avenues were opened to inventors. There existed, however, the entire field of qualities lower than 540 B.Th.U., which were in effect barred to gas authorities; and the Parliamentary approach to their exploitation, in the light of previous experience, prognosticated so serious a conflict, and the immense mass of capital invested in mains, meters and appliances all designed for the distribution and use of high-quality gases, provided so great an obstacle, that it may reasonably be doubted whether fifty years of peace would have achieved such a revolution in thought and practice as was brought about during the years 1914-18.

I may perhaps be pardoned for reminding you that the war would in all human probability have been lost by the Allies had it not been for the gas industry of Great Britain.

In June, 1917, the Fuel Research Board were asked by the Board of Trade to advise as to: "What is the most suitable composition and quality of gas and the minimum pressure at which it should be generally supplied, having regard to desirability of economy in the use of coal, the adequate recovery of bye-products, and the purposes for which gas is now used."

The conditions were making reduction of quality essential for almost all undertakings, and the use of blue water gas constantly extended. It was discovered that vertical retorts of the continuous type could be steamed, so as to make water gas at the same time as coal gas. The gas so produced was found most satisfactory in use. In 1918 was issued the "Gas-Works (Ministry of Munitions) Order, 1918," under which all gas-works having washing plants were authorized to reduce the quality of their gas to a minimum of 450 B.Th.U.; but lower qualities were already being supplied in many cases, more especially by municipal undertakings. Sir Dugald Clerk suggested that gas of about 420 B.Th.U. quality would serve the needs of the community satisfactorily, and even lower figures were named in other quarters. It is worthy of note that in Italy the quality of gas had been reduced so low as 225 B.Th.U., while in Holland 420 was the rule. American conditions favoured a higher quality, but in one State a reduction of 40 B.Th.U. was made, which brought the quality to 525 B.Th.U.; and no appreciable increase in the volume consumed was observed.

In 1919 the fuel situation became even more serious than during the war, and the question of coal conservation was receiving general attention. The Fuel Research Board issued their Report, which marked an epoch in the history of gas supply, for they recommended that each gas authority should be given power to settle its own quality, subject to the condition that the old system of selling by volume should be abolished and replaced by a new method of selling on the actual heat energy supplied. They also recommended that the percentage of inert constituents should be kept below 12 p.ct.; but this recommendation was subsequently amended on representations by the gas industry. The extended experience with gas made by steaming vertical retorts fully confirmed the earlier expectations, for it was found to be admirable in all respects, and gave complete satisfaction to consumers.

THE GAS REGULATION ACT.

In 1920 the gas industry received a new Charter in the Gas Regulation Act, 1920. Under this Act many of the Fuel Research Board's recommendations were carried into effect.

In describing the main provisions of the Act, the author said: Uniformity is in itself a "quality" in town gas, for the proportion of air required for combustion varies roughly in proportion to the calorific value for different qualities of gas made in a particular plant. Thus, should the quality fall to a serious extent below the average quality for which any gas apparatus is regulated, trouble may be experienced with irregular burning, lighting-back, or even extinction. There is in such cases certain inefficiency and possible danger; and a penalty is inflicted in order to compel constant attention to this point. Excessive rich-

ness should also be avoided; and it is at least open to argument whether restriction on this side is not almost as desirable as in the contrary direction. The framers of the Gas Regulation Act no doubt correctly took the view that self-interest and practical considerations rendered specific regulation in this connection unnecessary. Failure to keep above the penal line is punished very mildly in a financial sense, the fine being small compared with the interests at stake. The real penalty in such cases would, of course, consist in the publicity which would attend proceedings against any gas company for breach of the law. Competent gas administrators are probably unanimous in holding that self-interest alone should suffice to ensure the maintenance of an even higher standard of uniformity than called for by the Act. No advantage of even a temporary nature can be obtained by degrading the gas, for the further provisions ensure that the average quality for each quarter shall be the full declared value, and failure in this respect is made directly personal to every shareholder. The full value of any saving of costs in manufacture certified by the Chief Gas Examiner to be attributable to the lower quality supplied, will be taken out of the next dividend paid. This salutary provision is unique in law, and makes it possible to claim that the purchaser of gas by therm to-day is guaranteed as is the buyer of no other commodity.

The Act transfers, for the first time, to gas authorities the entire responsibility of settling the quality of gas. In past times the question of quality has been the subject of infinite disputation between suppliers and users as represented by local authorities. The extreme rigidity of the old system now gives place to almost complete freedom. Every gas undertaking operating under the Act is free to decide the best quality to supply with the plant and raw materials at its disposal, and to take full advantage of local circumstances as regards the market for residual products. Moreover, the field of invention in respect of production and utilization of gas is now open from the highest to the lowest qualities, instead of being confined within narrow limits, the lower of which would now be regarded as a gas of exceptionally high quality. Liberty is always open to abuse, and it is at least conceivable that this great privilege might have been wrongly used in the absence of some steadying influence such as is to be found in clause 1, sub-section 4*b* of the Act, which places upon the undertakers the responsibility to "alter, adjust or replace" burners so as to permit of the use of gas of the declared quality "with safety and efficiency." Subject to this condition and the giving of reasonable notice, the quality may be altered at will without any limit either high or low.

It is impossible to discuss here in any detail the varied considerations which affect the decision as to quality to be supplied in any particular cases; but some idea of the issues involved may be conveyed by taking two extreme hypothetical cases calling for the declaration of high and low calorific value respectively. Supposing an undertaking to possess a modern horizontal retort house fully equipped and capable of supplying the requirements of the area for a number of years, in reasonable proximity to supplies of good gas coals, and able to dispose of residuals (and in particular coke) at advantageous prices, such an undertaking would probably be able to supply the area most economically with gas of relatively high quality. Should the market for coke be exceptional, so that the average value per ton uniformly exceeds the cost of good gas coal per ton, the choice would probably be of the highest quality given by the coal available when carbonized in accordance with the principles of economy. Should the area be very scattered, and equipped with mains and meters having little margin for dealing with increased volumes of gas, this would affect the issue in the same sense as a favourable residuals' market, but to a less degree. Supposing an undertaking to have a small and inefficient carbonizing plant and a blue water gas or total gasification auxiliary plant, coupled with a relatively unsatisfactory market for residuals (especially coke), the choice would probably fall upon a relatively low quality. Should cheap coals suitable for use in total gasification plant be available, and the market for residual products exceptionally poor, this would incline the choice towards a still lower quality; and should the distribution system and meters be in general of ample size, with a large margin for dealing with the increased volumes of gas, this would facilitate the choice of low quality.

The Fuel Research Board, in recommending Parliament to give this power of choice into the hands of gas undertakers, practically without reserve, took a bold step. The adoption of the Report was an act of courage and statesmanship on the part of Parliament, and the gas industry received the new power with a full sense of privilege accorded and responsibility accepted.

In their considerations the Fuel Research Board had to take a wide view. They had to consider not only the immediate interests of producers and users of gas, but national interests involved in coal conservation, and the best use of coal for the provision of gaseous heat energy. One of the most pressing questions calling for solution was as to the relative usefulness of various grades of gas. Were units of heat in a gas of (say) 400 B.Th.U. quality as economical in use as in a gas of 500 B.Th.U.? It was apparent that, to render possible the free choice of quality, experimental proof of the correctness or otherwise of the view which was later crystallized into the phrase "One B.Th.U. is as good as another," was essential, and accordingly the Fuel Research Board and the Gas Investigation Committee of the Institution of Gas Engineers undertook simultaneous research into the relative efficiencies of various grades of gas in use. The Board's report of February, 1919, states clearly the result of the investigation up to that time. "The experimental proof of this parity is still incomplete, and all that can be said at present is that if the consumers' appliances are properly adjusted for the correct use of the grade of gas with which they are supplied, this parity may be tentatively accepted." Further inquiries confirmed the tentative conclusion of the 1919 report, and it became clear that on the assumption that only actual heat energy supplied was paid for, the interests of consumers were not incompatible with a large measure of freedom in the choice of quality in any area.

Having settled this vital question of principle, it only remained to set up machinery to ensure that consumers should actually obtain the heat energy paid for; and the unique penal and testing provisions which apply to the sale of gas by "therm" were evolved to that end.

Composition of Town Gas.

After the extraction of sulphuretted hydrogen there remains in the gas an amount of sulphur, as carbon bisulphide and other compounds, equal to from 20 to 60 grains per 100 c.ft.; and the question as to whether and to what extent this sulphur ought to be extracted was the cause of much controversy between 1842 (when a Committee was appointed to investigate the impurities in gas) until the passing of the London Gas Act, 1905, which relieved the London Companies from restrictions as to sulphur compounds other than sulphuretted hydrogen. This relief was attributable to the report of a Departmental Committee in 1904, which contained the following passage: "Those who contend for the maintenance of the clauses relating to sulphur compounds have not sufficiently shown that their abolition in the case of the London Companies would be detrimental to the public."

Within a brief period of the passing of the Act of 1905, short Acts were passed extending the relief to provincial companies whose Acts contained sulphur clauses; and there are now no such clauses in existence. There is, however, a reference to sulphur compounds, or rather to carbon bisulphide, on the Statute Book; and it is of special interest. The South Metropolitan Gas Company appear to have been parties to the Act of 1905, not so much because of disbelief in the desirability of low sulphur content in gas, as because there was no effective, reliable, and inoffensive known means of removing it. This Company therefore undertook independent research into the possibility of purification by heat. Throughout the history of gas, inventors have from time to time proposed methods of combining carbon bisulphide with hydrogen to produce sulphuretted hydrogen and carbon, but no success was achieved on a practical scale until in 1908 the Portland Gas and Coke Company of Oregon, U.S.A., installed plant which in one year treated over 800 million c.ft. of gas, with an average efficiency of extraction of 71 p.ct. In 1912 the South Metropolitan Company erected a plant of their own design to deal with 1½ million c.ft. per day; and this proved so successful that the system was extended to the Company's entire production of gas. Over one year's working, the carbon bisulphide was reduced from 39·74 grains per 100 c.ft. to 8·22 grains—an efficiency of extraction of 79·3 p.ct.

In the South Metropolitan Gas Act, 1920, appears (clause 21) a remarkable provision that, if for any year or half-year the Chief Gas Examiner certifies that the average proportion of carbon bisulphide vapour in the gas fails to exceed one part in 40,000, the price of gas shall for the purpose of calculating the dividend payable be deemed to be ¼d. per therm less than that actually charged. Parliament thus in effect accepted the view that sulphur extraction is of a value to the consumer of not less than ¼d. per therm. The importance of the question has lessened continuously since the introduction of the incandescent mantle, and this doubtless explains why no other undertaking—company or municipal—has, so far as I am aware, followed the lead of the South Metropolitan Gas Company. With this exception there would therefore appear to be substantial unanimity of opinion on the part of users and suppliers of gas that with gas as now made and consumed sulphur extraction is not of sufficient value to justify the expense.

The Fuel Research Board in their Report of 1919 recommended that the proportion of inerts should be restricted to 12 p.ct.; but this was modified on representations from the gas industry. The whole question of the importance of inerts was so evidently highly contentious that the Gas Regulation Act provided—clause 2, sub-section 4—that, as soon as possible, the Board of Trade should hold an inquiry "into the question whether it is necessary or desirable to prescribe any limitations of proportions of incombustible constituents which may be supplied in gas." An inquiry was held, and the Departmental Committee reported against restriction of inerts for the time being, but recommended that further inquiry should be made at a later date. From the consumer's point of view, the presence of oxygen or air has no appreciable effect except upon the flat-flame burner. Under the therm system no advantage can possibly accrue from adding air to gas—only heat units being paid for.

Agitation regarding the carbon-monoxide content in gas was doomed to failure, for, though a Committee reported in 1898 in favour of a restriction of CO to 12 p.ct., no action was taken, and increased experience strengthened the universal opinion of gas engineers that reasonable proportions of carburetted water gas could safely be distributed; and before the war this view had become fully established, supported as it was by the remarkably low mortality statistics relating to deaths from inhaling town gas.

It was not surprising that attention should again be called to the carbon monoxide in town gas, in view of the great change in practice which had occurred since the inquiry of 1898; and Parliament's intention to give gas undertakings freedom to choose their own quality made it essential that a further inquiry should be undertaken. Such an inquiry was called for in clause 2, subsection 4, of the Gas Regulation Act. The Committee to whom the question was remitted reported, on July 1, 1921, against any limitation.

APPENDIXES.

The paper was accompanied by six appendixes. The first three of these showed respectively the relation of illuminating power and calorific value in the gas of London and provincial undertakings (the figures being taken from "Field's Analysis" for 1914), and the effect of the admixture of blue water gas with rich coal gas; statistics relating to the number of deaths in England and Wales during the year 1921; and the oxygen and air required for combustion, calorific value, &c., of various gases. The following three tables comprised the remaining appendices.

Discussion.

Dr. R. LESSING congratulated the author on having summarized the position in such a remarkably concise and useful manner. There was very little in the paper for discussion, so far as discussion meant criticism. The therm had been agitating the minds of many people; but he believed that all that was required was for the public to have a little time to accommodate its mind to the new conditions. After all, he did not believe that the man in the street in the days gone by had a clear conception of what a cubic foot of gas meant. The cubic foot was accepted because the consumer knew what a thousand cubic feet would do for him in his domestic or other requirements. It was exactly the same with the therm. It was merely an expression of a certain value. He was one of the first, if not the first, to recommend that gas should be sold on the basis of calorific value, because he submitted a report to one of the London Gas Companies in 1917. He was forced to that conclusion by the study of the composition of gas made during the war. The gas at that time was stretched by the inclusion of inert substances; and he felt convinced that it would be for the benefit of the consumer to have calorific value as the basis of his gas account. This opinion had been amply justified; and no one in his senses to-day would go back to the cubic foot basis, unless he was certain that the quality of the gas would never change during the time he was paying on that basis. Carbon monoxide had been attracting a great deal of attention from certain busybodies who wanted to get "copy" for the daily newspapers. Ever since coal gas was introduced it had contained carbon monoxide. The carbonization of coal entailed the production of carbon monoxide, and, from the hygienic point of view, the quantity was only of importance where the gas was actually inhaled. Where it was used for its proper purposes, it did not matter in the least how much carbon monoxide was present, provided the gas was kept within the mains and services until it reached the point where it was to be burned. Probably the cases of suicide by coal gas would be just as frequent if there were no carbon monoxide in it at all, because nobody would live very long in an atmosphere of methane, hydrogen, or any atmosphere which did not contain the requisite amount of oxygen for sustaining the mechanism of human life. The carbon-monoxide bogey had been disposed of by the report of the Government Committee which inquired into the matter and came to the conclusion that no limitation need be applied. It was therefore to be hoped that the public would remain assured that there was no danger arising from it. Another point admirably dealt with in the paper was the chemical composition of gas. He was a chemist, and could not help looking at every problem from a chemical point of view. It must always be remembered that, in making gas, the gas itself, quantitatively speaking, was only a comparatively small product of the coal used. Gas undertakings had to deal with eight or nine times the quantity of coal compared with the amount of gas actually sent out. This was a point which the general public, perhaps, never realized. While the gas itself might be regarded as a comparatively minor product, coke, smokeless fuel, and many other bye-products essential to modern domestic and industrial life, were produced. The atmosphere could be made purer by a greater use of gas and coke, and a less use of coal. The gas industry was one of the key industries, if not the most important key industry. Those who were called upon to criticize or to advise on matters appertaining to gas ought to bear in mind the enormous strides which have been made during the last twenty years, and which are still being made with redoubled efforts.

Alderman W. MUIRHEAD (Liverpool) said he did not like the frivolous manner in which Dr. Lessing had referred to carbon monoxide, because the public regarded the matter as a serious one. After all, it was impossible completely to eliminate leakage from gas pipes and mains; and therefore the danger from carbon monoxide should be lessened as much as possible. There had been several deaths due

Composition of Various Mixtures of Coal Gas and Carburetted Water Gas.

COAL GAS—COAL GAS AND CARBURETTED WATER GAS—CARBURETTED WATER GAS—AND BLUE WATER GAS.

The analyses were selected from tests covering a long period, and do not represent the constitution of gases produced by blending various percentages of particular stored samples of coal gas and carburetted water gas. The quantity of oil used per 1000 c.ft. of carburetted water gas is given in each case.

Nature of Gas.		Coal Gas.	Coal Gas and C.W.G.	Coal Gas and C.W.G.	Coal Gas and C.W.G.	Coal Gas and C.W.G.	Coal Gas and C.W.G.	C.W.G.	Blue Water Gas.
		P.Ct.	P.Ct.	P.Ct.	P.Ct.	P.Ct.	P.Ct.	P.Ct.	P.Ct.
Carbon dioxide	CO_2	2·3	3·7	3·8	4·2	4·9	3·8	6·2	5·4
Unsaturated hydrocarbons	—	2·4	3·7	3·5	4·5	4·9	4·8	7·2	—
Oxygen	O_2	0·3	0·9	0·5	0·9	0·7	0·7	0·5	0·2
Carbon monoxide	CO	8·2	8·3	11·7	16·0	20·6	22·7	29·8	38·8
Methane	CH_4	24·8	26·0	22·6	20·0	16·2	16·8	9·7	0·6
Hydrogen	H_2	47·7	45·4	42·6	41·8	40·8	41·3	40·4	48·2
Nitrogen	N_2	14·3	12·0	15·3	12·6	11·9	9·9	6·2	6·8
Total inerts	—	16·9	16·6	19·6	17·7	17·5	14·4	12·9	12·4
Total inerts on air-free gas	—	15·7	12·8	17·6	14·0	14·7	11·5	10·8	11·5
Observed calorific value	B.Th.U.	496	539	488	505	474	480	490	—
Calculated calorific value	,,	489	528	489	497	478	489	490	284
Calculated specific gravity	Air = 1	0·46	0·49	0·53	0·56	0·59	0·58	0·64	0·56
Total carbon	p.ct.	39·0	42·5	38·8	40·7	40·6	42·3	45·0	33·1
Combustible carbon	,,	36·9	39·4	35·9	37·6	37·2	39·5	40·9	29·1
Additional air required per c.ft. gas	c.ft.	4·19	4·50	4·17	4·20	4·02	4·12	4·12	2·12
Calorific value of self-combustible mixture (observed)	B.Th.U.	96	98	94	97	95	94	96	—
Calorific value, calculated	,,	94·2	96	94·6	95·6	95·2	95·5	96	91
Total volume of products of combustion per c.ft. "gas"	c.ft.	4·92	5·25	4·92	4·93	4·74	4·82	4·80	2·68
Volume of products of combustion after condensation of water	,,	3·88	4·16	3·94	3·98	3·86	3·93	3·99	2·19
Calculated composition of products of combustion: CO_2	p.ct.	8·6	9·3	9·9	10·9	11·9	12·0	14·0	16·7
Water vapour	,,	21·2	20·7	20·0	19·3	18·5	18·5	16·9	18·3
N_2	,,	70·2	70·0	70·1	69·8	69·6	69·5	69·1	65·0
Total hydrogen per c.ft. gas	c.ft.	1·04	1·09	0·98	0·95	0·88	0·89	0·81	0·49
C.W.G. assessed from analysis	p.ct.	*Nil*	5	20	39	59	68	100	—
Oil per 1000 c.ft.	gallons	*Nil*	2·69	2·14	2·00	2·18	2·26	1·99	—

Composition of Coal Gas and Producer Gas Mixtures.

An undertaking having declared 480 B.Th.U. under the Gas Regulation Act was compelled to put its carburetted water-gas plant out of operation for extensive repairs. In order to avoid the evils and inefficiency of reducing the coal gas quality by pulling waste gases into the gas through the cracks in the retorts, a producer was installed, and the producer gas made was drawn continuously into the stream of gas after manufacture, but before leaving the retort house. The table gives three typical analyses of the mixed gases, which were consumed for a considerable period with complete satisfaction.

		P.Ct.	P.Ct.	P.Ct.
Carbon dioxide	CO_2	3·4	3·2	2·3
Unsaturated hydrocarbons		2·2	2·2	2·1
Oxygen	O_2	0·2	0·4	0·3
Carbon monoxide	CO	11·0	11·5	10·4
Methane	CH_4	26·3	23·1	23·4
Hydrogen	H_2	42·6	45·9	46·2
Nitrogen	N_2	14·3	13·7	15·3
Total inerts		17·9	17·3	17·9
Total inerts on air-free gas		17·1	15·7	16·7
Observed calorific value	B.Th.U.	483	485	479
Calculated calorific value	,,	491	472	469
Calculated specific gravity	Air = 1	0·51	0·49	0·48
Total carbon	p.ct.	39·0	38·3	37·1
Combustible carbon	,,	36·2	35·5	35·2
Additional air required per c.ft. of "gas"	c.ft.	4·24	4·04	4·01
Calorific value of self-combustible mixture	B.Th.U.	92	96	96
Calorific value calculated	,,	94	93·6	93·6
Total volume of products of combustion per c.ft. "gas"	c.ft.	4·98	4·76	4·74
Volume of products of combustion after condensation of water	,,	3·96	3·77	3·75
Calculated composition of products of combustion: CO_2	p.ct.	9·5	9·3	9·1
Water vapour	,,	20·4	20·8	20·9
N_2	,,	70·1	69·9	70·0
Total hydrogen per c.ft.	c.ft.	1·02	0·99	0·99

Typical Analyses of Town Gas Supplied by Various Gas Undertakings.

Ref. No.	Nature of Gas.		A. Horizontal Straight Coal Gas.	B. Coke Oven Gas.	C. Coal Gas + 25 P.Ct. C.W.G. (1·1 Gallons Oil per 1000 C.Ft.)	D. Horizontal Retort Coal Gas + Slight C.W.G.	E. —	F. Straight Coal Gas from Horizontals and Inclined Retorts + Blue Water Gas.	G. Verticals. Coke Ovens. Horizontals. Water Gas.	H. Coal Gas + 25 to 30 P.Ct. C.W.G. (1 Gallon per 1000 C.Ft.)	J. Coal Gas from Verticals + 36·3 P.Ct. Water Gas.	K. Coal Gas from Horizontals + C.W.G.	L. Straight Coal Gas from Horizontals + Tully Gas from Coal and Coke.	M. Coal Gas + 60 P.Ct. Water Gas.	N. Coal Gas + 45 P.Ct. Water Gas.	O. Coal Gas + Tully Gas.	P. Tully Gas from 65 P.Ct. Coal and 35 P.Ct. Coke.	Ref. No.
			P.Ct.	P.Ct.	P.Ct.	P.Ct.	P Ct.	P.Ct.	P.Ct.	P.Ct.	P.Ct.	P.Ct.	P.Ct.	P Ct.	P.Ct.	P.Ct.	P.Ct.	
1	Carbon dioxide	CO_2	1·5	2·0	2·2	3·48	5·6	3·2	4·0	5·3	4·4	5·2	6·8	6·3	10·3	5 4	10·9	1
2	Unsaturated hydrocarbons	.	3·0	2·8	1·8	2·20	2·8	1·7	2 5	2·49	1·9	3·2	1 6	0·6	1·6	1·2	0·3	2
3	Oxygen	O_2	0·2	0·8	1·3	0·92	1·5	0·8	0·9	0·5	0·8	0·6	0·3	0 5	0·8	0·6	0·2	3
4	Carbon monoxide	CO	7·0	6·7	11·3	9·90	11·6	18·3	13·4	17·14	20·9	6·42	13·9	21·2	14·7	12·8	27·2	4
5	Methane	CH_4	29·7	30·4	25·2	26·04	22 9	19·6	2·27	22·94	15·3	22·9	18·5	17·2	20·68	19·1	4 9	5
6	Hydrogen	H_2	52·4	49·2	53·08	45·79	46·4	48·2	45·0	42·61	48·5	35 39	49·2	49·2	36·8	55·0	46·9	6
7	Nitrogen	N_2	6·2	8·1	5·32	11·67	9·2	8·2	11·5	9·02	8·2	26·29	9·7	5·0	15·12	5·9	9·6	7
8	Total inerts	CO_2 O_2 N_2	7·9	10·9	8·82	16 07	16·3	12·2	16·4	14·82	13·4	32·09	16·8	11 8	26·2	11·9	20·7	8
9	Total inerts	Air free	7·02	7·38	2·80	12·22	9 86	8·72	12·66	12·75	9·97	30·1	15·6	9·65	23·28	9·3	19·8	9
10	Observed calorific value	B.Th.U.	561·7	560	497 4	500·5	490	489	487	481	441	434	429·35	411 5	411·8	403	283·77	10
11	Calculated calorific value	"	564·3	554·8	504	494·8	487	452	478·3	485	424	446	428	411	412	438	293	11
12	Calculated specific gravity	Air = 1	0·399	0 427	0 412	0·481	0·504	0·482	0·506	0·533	0·504	0·602	0·496	0·493	0·618	0·432	0·588	12
13	Total carbon	p.ct.	50·2	47·0	45·0	40·3	40·6	40·2	39·7	41·7	38·6	31·1	37·2	39·3	34·3	39·7	31·1	13
14	Combustible carbon	"	48·4	45 0	42·7	37·2	36·0	37·4	36·3	37·6	34·9	27·5	31·5	34·0	27·3	34·4	23·4	14
15	Additional air required per cubic foot of gas	c.ft.	4·88	4·84	4·26	4·23	4·09	3·78	4·04	4·12	3·48	3·83	3·59	3·42	3·50	3·66	2·29	15
16	Calorific value of self-combustible mixture on observed calorific value	B.Th.U.	96	96	94·6	96·0	95	102	97	94	98	89·9	93·5	93	91	86	86·2	16
17	Calorific value of self-combustible mixture on calculated calorific value	"	96	95	95·8	94·6	95·7	94·6	94·9	94·7	94·6	92·3	93·3	93	91·5	94	89·1	17
18	Products of combustion per cubic foot of gas	c.ft.	5·6	5·56	4·95	4·96	4·81	4·45	4·76	4 83	4·14	4·64	4·28	4·07	4·25	4 33	2·92	18
19	Products of combustion after condensation of water vapour	"	4·39	4·38	3·86	3·92	3 81	3·52	3·78	3 87	3·29	3 73	3·37	3·22	3·42	3·36	2 35	19
20	Composition of products of combustion — CO_2	p.ct.	8 4	8·5	8·9	9·3	10·1	10·3	10·0	10·9	11·2	9·5	10·3	11·4	11·9	9·5	15·0	20
21	Composition of products of combustion — Water vapour	"	21·6	21·3	22·0	21·0	20·9	20·8	20·6	19·8	20·5	19·6	21·3	21·0	19·5	22·4	19·7	21
22	Composition of products of combustion — Nitrogen	"	70·0	70·2	69·1	69·7	69·0	68·9	69·4	69·3	68·3	70·9	68·4	67·6	68·6	68·1	65·3	22
23	Total hydrogen per cubic foot	"	1·21	1·18	1·09	1·04	1·00	0·93	0·98	0·96	0·85	0·91	0·91	0·85	0·83	0·97	0·57	23

to it in Liverpool; and the Liverpool analyst's opinion was that it materially helped in these fatalities. A limit should be imposed.

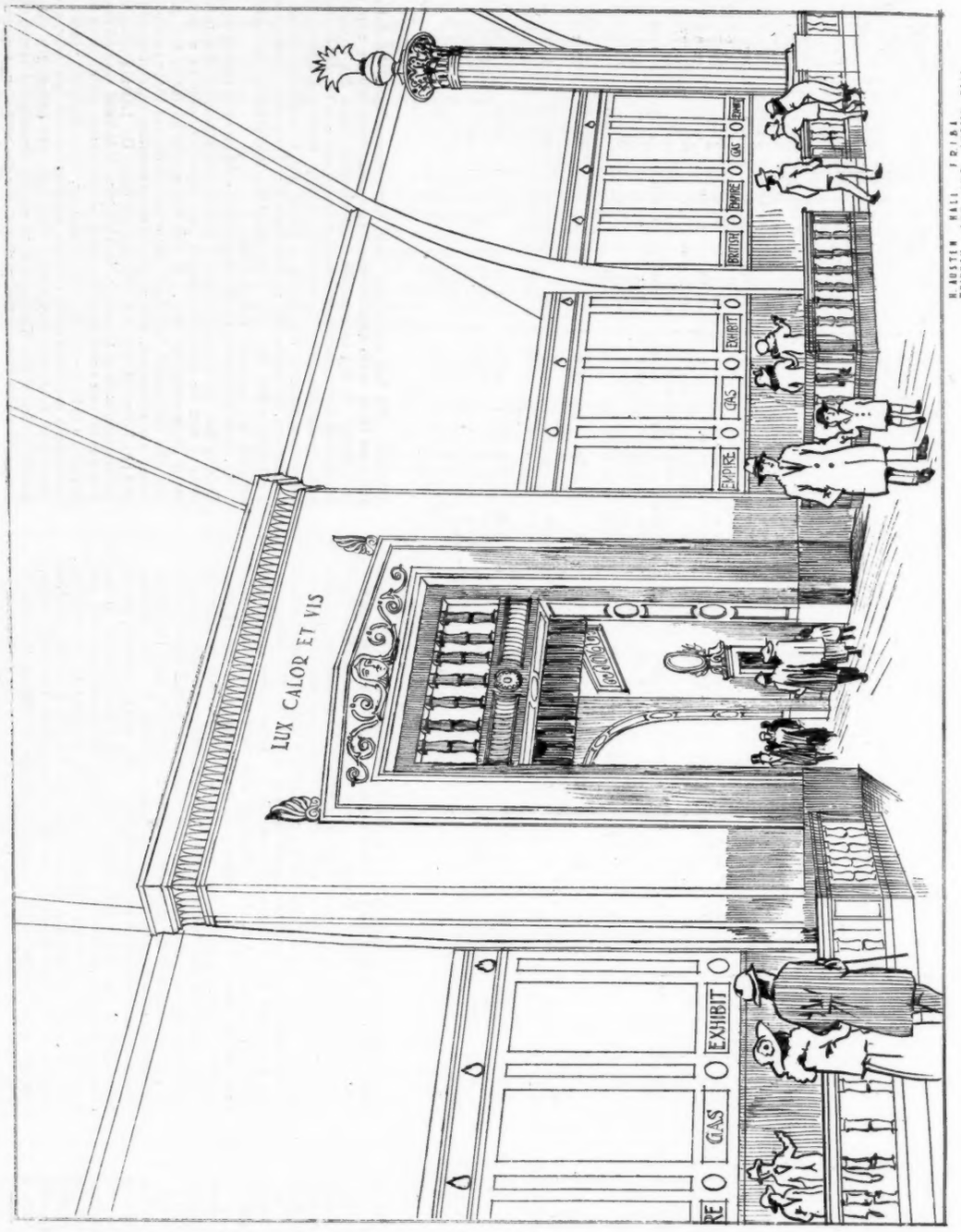
Councillor P. M. KIRKPATRICK (Hamilton) said his authority had just received an Order under the Gas Regulation Act, and would soon be fixing a standard calorific value. He asked whether the author thought it wiser to fix a standard as near as possible to the quality of gas supplied at the present time, or to fix a standard with a certain margin of safety, having regard to the penalties imposed under the Gas Regulation Act. If the gas now supplied was from 460 to 470 B.Th.U., would a good figure be 450 or 460?

Mr. T. E. SALTER (Tipton) remarked that nothing had been mentioned in the paper as to the penalties which could be imposed upon a municipal gas authority if it did not supply the prescribed quality.

Mr. G. EVETTS said he would like to amplify two matters not sufficiently dealt with in the paper, with the object of having the record as accurate as possible. The paper stated that in 1866 the Sheffield Gas Company were granted the first sliding-scale as we now know it. As a matter of fact, in 1855 the Sheffield Company had an Act of Parliament, in which the dividend on one class of stock varied with the price. In 1866 that scheme was amplified to include all new capital authorized under that Act, but it contained a limitation in the upward and downward direction, and a limitation of price, coupled with a maximum of 4s. He believed that the Commercial Gas Company were the first to adopt the sliding-scale in 1875; and it was interesting to note that the Gas Light and Coke Company, who promoted a Bill themselves in that year, opposed this sliding-scale, which was on the basis of equal steps of dividend up or down as the price went down or up. However, the Commercial Gas Company got their Act; and other companies quickly followed. The next point was with regard to the standard calorific value. It was stated in the paper that the Gas Light and Coke Company in 1909 obtained a value of 125 calories. Later this figure was altered to 540 B.Th.U.; but this was not the penalty margin. There was a margin of 7½ p.ct. before the Company became liable; and this brought the figure down to 500 B.Th.U. When the Gas Light and Coke Company came for an Order under section 1 of the Gas Regulation Act, the conversion was made not on the basis of 540, but of 500 B.Th.U., because of the existence of the 7½ p.ct. penalty margin. Later in the paper, the author said that in 1912 the South Suburban and Wandsworth Companies obtained Acts incorporating the principle of calorific value only, and that in their case the old 14 c.p. was replaced by 540 B.Th.U. As a matter of fact, the South Suburban had a penalty margin down to 475 B.Th.U. The Wandsworth figure was not expressed in B.Th.U., but as 136 calories, which was equal to 540 B.Th.U. They had a penalty margin down to 122 calories, equal to 480 B.Th.U. Continuing, Mr. Evetts said that the passing of the Gas Regulation Act had been justified by the results. The gas industry quickly showed that the flexibility which the Gas Regulation Act gave them, in the option to declare a calorific value, was going to be taken the utmost advantage of; and at the present time there were standards of gas in different parts of the country varying from 375 to 560 B.Th.U. These figures represented wide margins in the actual mixtures, and the plants used. With regard to the last appendix, this showed gases of calorific values ranging from 564 to 293 B.Th.U. The distribution costs of these two gases were very different. He had calculated how many therms could be delivered along an 18-in. main approximately two miles long, with a 2-in. pressure drop. In the case of the high calorific value gas it would be possible to distribute 390 therms per hour; while in the other case the quantity would only be 167 therms per hour. Even if it were economical to manufacture the lowest grade of gas, it might, in certain circumstances, be impossible to distribute it. Therefore, when declaring a calorific value, not only must economic manufacture be taken into account, but economic distribution.

Mr. BLOOR, replying to the discussion, said he fully agreed with Dr. Lessing that the average consumer had no conception of what 1000 c.ft. meant; and he doubted whether one electricity user in a thousand really understood the unit. It did not matter so far as the general user was concerned, but it did matter in the case of those to whom the paper was addressed, who might have to consider regulation of prices and conditions of sale, &c. He did not think Dr. Lessing was treating carbon monoxide as flippantly as Alderman Muirhead seemed to think. The gas industry had great interests in this matter, which were far too important to be treated in a casual manner. For a hundred years 25 million people had lived daily in close association with coal gas, and yet there had been few accidents. Coal gas was amazingly safe. In answer to Councillor Kirkpatrick, he would recommend him to declare a calorific value close to the quality of the gas now being supplied, and then see to it that the management turned out as uniform a quality as possible. Uniformity was the most vital attribute of gas supply. He recommended everyone to work fully in accordance with the spirit of the Act—to be, if anything, more rigid than the Act itself.

THE GAS EXHIBIT AT WEMBLEY.



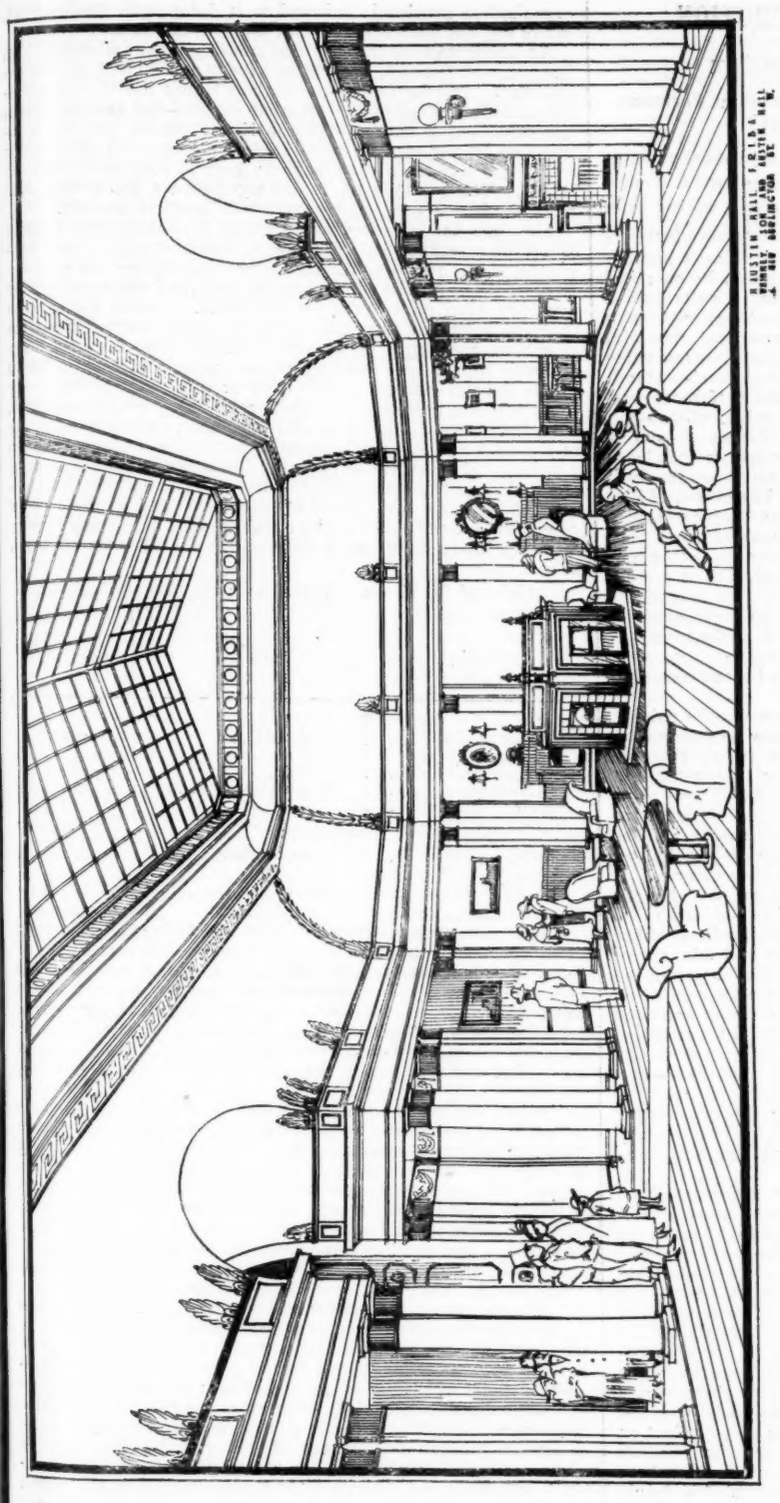
The fact has been emphasized in previous issues of the "JOURNAL" that the Gas Exhibit at Wembley is a co-operative affair for the whole industry, and not a matter for individual gas undertakings or manufacturing firms. Therefore the subscriptions of the small undertakings and other concerns associated with the gas industry will be as welcome as the hundreds or thousands of pounds of the larger enterprises. Every undertaking, it is hoped, will do its part in furnishing funds—the earlier the better, so that the Executive may shape their plans accordingly. The most effective use and the fullest result must be secured from the site that has been taken; and this is all a question of money. The gas industry's place in the country as a public utility has to be demonstrated nobly on this occasion; and this can be done by co-operation.

In connection with the sketches published this week, reminder may be given that the space taken for the exhibition has an over-all area of 12,637 sq. ft. The first main feature of the exhibit is the large room entered directly from the main entrance portico. This room or hall (seen in second drawing) is 100 ft. by 50 ft. between walls. It is proposed to furnish this as a Rest Lounge, designed to constitute a section illustrating the applications of gas to domestic lighting and heating. In this lounge, visitors will be able to take their ease—a rare but much desired possibility at an exhibition, and at the same time will have much to interest them.

The rest lounge, lighted by fittings suitable for a large business salon or public hall, is planned to be surrounded by indications of fourteen model apartments, from 11 ft. to 19 ft. wide by 8 ft. deep, illustrating the lighting and heating of various rooms, such as: Drawing-room, dining-room, library, boudoir, smoking-room, nurseries, bathrooms, bedrooms (hotel and private), and dressing-rooms. Various novel features will be exhibited in connection with the lounge.

In the middle of the lounge, it is proposed to show three hexagonal groups of fire-places to exhibit a further eighteen gas-fires in different settings. Above the fire-places, it is proposed to show the original drawings and paintings by first-class artists that have been used for "B.C.G.A." advertisements, or other interesting pictures or diagrams.

The second half of the interior—a Demonstration Hall, 100 ft. by 50 ft. (between walls)—is planned in sections to illustrate the applications of gas to (*a*) the lighting of business premises; (*b*) cooking, bread baking, and home laundry work; (*c*) hot water supply for all purposes; and (*d*) industrial processes of many varieties. It is intended that practical demonstrations shall be arranged of cooking, bread baking, sweet making, &c., and home laundry work, and also of many of the industrial processes. Much greater space has been devoted to the heating, industrial, and water-heating sections than to the cooking section. The Executive are of opinion that the public of to-day need more education in the possibilities of gas under these three headings than they do in its use for cooking.



It is proposed that inquiry bureaux should be established—one in the Rest Lounge, for heating and general inquiries; and two in the Demonstration Hall, for domestic and industrial inquiries, respectively.

In the ante-room between the Lounge and the Demonstration Hall, it is suggested that photographs and pictures should be placed illustrating the processes of gas manufacture and distribution from coal seam to consumer's meter.

GAS MAINLAYING WORK AT THE EXHIBITION.

Wembley lies within the area of supply of the Harrow and Stanmore Gas Company, who have given careful consideration to the necessity for an adequate supply to the Exhibition.

Provision is being made to meet a consumption of 700,000 c.ft. per diem; and to this end an 18 in. main has been run to the western boundary of the Exhibition, to a point at the rear of the New Zealand Exhibit and near the Malay Exhibit. At this point, it is intended to erect two station meters, having a nominal capacity respectively of 50,000 and 30,000 c.ft. per hour. From these meters, a "ring" main 12 in. in diameter has been laid, from which subsidiary mains have been run with cross feeds through the main buildings. Altogether, no less than 5 miles of mains will be laid in the Exhibition.

The main-laying work within the Exhibition is being carried out by the Exhibition contractors, Sir Robert M'Alpine and Sons.

NOTES FROM OFFICIAL SOURCES.

From official sources we have received the following notes:

The hours of opening and closing of the British Empire Exhibition (which starts next April) have now been fixed. The grounds will be open from 10 a.m. to 11 p.m., except Sundays. Exhibits will be on view from 10 a.m. to 10 p.m. No exhibitor will be required to keep any machinery moving or full staff in attendance at stalls after 8.30 p.m. from Mondays to Fridays inclusive, or after 9.30 p.m. on Saturdays; but otherwise exhibitors will be expected to keep their exhibits fully on show between 10 a.m. to 10 p.m. In regard to sales, exhibitors will be permitted to arrange their own hours between 10 a.m. and 10 p.m., subject to the provisions of the Shop Hours Act.

Preparations for the World Power Conference proceed apace; and during the past few days several distinguished contributors, on subjects of outstanding importance, have been added to the programme. Dr. C. H. Lander, Director of the Fuel Research Board, will contribute a "National Survey" of his special province; while Sir George Beilby, F.R.S., LL.D., Member of the Advisory Council on Scientific and Industrial Research, will present a "National Survey of Oil Resources." "The Winning and Utilization of Peat"—a subject of considerable economic importance—will be dealt with by Prof. Pierce Purcell, of University College, Dublin, who is a leading authority on this subject. Cement interests will note with satisfaction that the combustion of powdered coal in cement rotary kilns is to have a place in the programme. It will be handled by Dr. G. Martin, of the British Portland Cement Research Association.

The Associated Advertising Clubs of the World are to hold their next great Convention in London. For twenty years the Annual Convention has been held in New York. The fact that the British Empire Exhibition is being held at Wembley in 1924 furnished the British representatives with the opportunity to swing the 1924 Convention to this side of the water; and our advertising men will now be able to show the world that British traders are as alive to the importance of publicity as the Americans, and that their standard, both as regards literature and display, is higher than in any other country. Both our own experts and those from overseas whom they will be called upon to entertain next year, agree that the British Empire Exhibition itself will in the highest and best sense be a stupendous feat of national and imperial advertising. In July next, London will be invaded by an army of delegates from the United States and from the British Dominions. The former country alone will send over 2000 representatives, while the total number of advertising experts from overseas will exceed 5000.

Institution of Heating and Ventilating Engineers.—A meeting will be held on Dec. 5, when Mr. A. J. Assheton will lecture on "Vacuum Steam Heating." The meeting will be held at the Engineers' Club, Coventry Street, W. 1.

Institution of Engineers-in-Charge.—Mr. G. Evetts, M.Inst.C.E., is to read a paper on "Recent Developments in the Production of Town Gas" at a meeting of the Institution in St. Bride's Institute, Bride Lane, Fleet Street, next Wednesday evening (Dec. 12), at 7.30. The paper will be illustrated by lantern slides. Mr. G. W. Carey has promised to take the chair.

Cantor Lectures by Mr. E. V. Evans.—A series of three Cantor Lectures before the Royal Society of Arts is to be delivered by Mr. E. V. Evans, O.B.E., F.I.C., Chief Chemist to the South Metropolitan Gas Company, who will take for his subject "A Study of the Destructive Distillation of Coal." The lectures will be delivered at 8 o'clock on Mondays, Feb. 25, March 3, and March 10.

SOME ASPECTS OF DISTRIBUTION.

By SAMUEL B. CHANDLER, A.M.I.Mech.E.

[A Paper read before the Southern Association of Gas Engineers and Managers, on Nov. 27, 1923.]

When your President asked me to contribute a short paper to the Association, the time permitted for me to prepare a few notes was somewhat short, and the task of opening-up a subject sufficiently alluring and interesting presented rather difficult features.

We have lately heard a great deal about the large number of uses to which gas may, in some form or other, be put; and the recent British Commercial Gas Association's Conference in Birmingham, which attracted not only many gas engineers, but a large section of the general public, has served a particularly useful purpose in bringing home to the man-in-the-street the great value of gaseous energy, from national, health, and utilitarian standpoints. One of the most striking features of the conference was, I think, the high testimony paid by prominent public officials and great business men to the remarkable effect the use of gaseous energy has upon their various businesses and trades, and the large part which gas plays in the thousand-and-one processes involved in the production of machine-finished goods. The citizen of Birmingham may rightly be considered one whose business ability is unquestioned; and if testimony can be obtained from him, and not only from him, but from many other large users throughout the Kingdom, it would appear that gas, having been proved capable of meeting practically all requirements—furnace, industrial, and other work—the main point now to be considered by the industry is the cheapening of the therm, to make town gas the one and only fuel, by the adoption of which those very desirable results outlined by Dr. Saleeby may (in common with many other economies) be effected.

I feel I shall find you in agreement when I venture the opinion that the distribution side of our industry has now become as important as that of manufacture; for, while it is one thing to make good-quality gas, it is, in these days of keen competition in all phases of fuel supply, quite another to sell it. Those of us whose work is confined almost wholly to sale and distribution realize the new conditions requisite for increased output, and the great importance of presenting to the consumers (potential and otherwise) the case for town gas in the most effective manner. It is therefore not only desirable, but absolutely necessary, that the industry should have at its disposal men of technical ability, capable of grasping the principles underlying the business of gas supply, and able to enunciate these principles and advantages (so well known and appreciated by those within the industry) in a manner which will favourably influence, and bring conviction to, the minds of the consumers. The thought which comes to me as worthy of consideration may now perhaps be regarded as commonplace, but nevertheless is more important to-day than ever before in the history of the industry. It is this—that to render the best service to the gas industry, the securing of the completely satisfied consumer is a *sine qua non;* this constituting the beginning and the end of gas salesmanship, and the foundation upon which the prosperity of the industry is built and maintained.

Particular attention is paid by the Company with which I am associated to ensure that all work done is of a satisfactory nature; and means are in operation whereby every consumer has an opportunity of expressing satisfaction, or otherwise, with the work carried out and the apparatus recommended and supplied by the undertaking. The organization of distribution departments has long been recognized by the larger undertakings as a means to this end, and essential to the advancement of their business. In this connection, we must, I think, give pride of place to the South Metropolitan Gas Company, who have done so much and were among the first to realize its importance. From what I can gather, however, the establishment of these special sections, though certainly not uncommon, is by no means so prevalent as it should be; and, while having great regard for the valuable organization of the British Commercial Gas Association, I believe salvation, to some extent, at least for individual companies, should come from within those bodies themselves. Of course, we cannot afford to disregard the great and efficient organization represented by the "B.C.G.A.;" and its value as time passes must enhance the reputation already achieved.

Scarcely any two schemes are alike. General principles of organization can be evolved and practised, but circumstances differ in almost every instance, and the character of the district demands, in some cases, different treatment in the relation between company and consumer. All realize fully the considerable advantages of electricity in certain phases of national and public life, but it is also recognized that its application to industry is determined by many factors about which the general public does not particularly concern itself, and that much work of an educative character has still to be done. Every individual is in some way or other concerned with the gas industry. The claims made that its processes involve the least waste of fuel, confer considerable benefits in all directions, improve the health of the community, and obtain for the consumer constancy of supply and the production of cheap light, heat, and power, can all be justified by those concerned; and every opportunity should be taken by undertakings themselves to induce realization, in which direction the organization previously referred to is doing such sterling work. Many ways of achieving this end occur to the author.

Advances made by the electrical industry, in the form of lighting, heating, and domestic apparatus, have been well met by the gas industry. The flat flame—the carbon lamp; the "C" mantle—the metallic filament; the inverted burner—the gasfilled lamp; the superheated burner with the No. 2 mantle, and the high-pressure burner with its remarkable efficiency—all tell a tale in which gas has more than held its own in this direction as in others. The gas industry to-day represents a highly organized body combining scientific research with business acumen.

The 1920 Act advanced the industry a considerable distance along the scientific road; the therm, which, despite Press campaigns, is fast obtaining the consumers' confidence, allowing calculations to be computed upon proper lines, and with much greater accuracy than under previous standards. I have yet to learn that the supply of electrical energy upon the thermal basis has ever been questioned or possibly understood by the user. The adoption of the new standard places valuable data in the hands of the technical officer; and the effect of informing a potential user that the therm represents a definite relation between gaseous and electrical energy forms a cogent argument, generally in favour of gas. One may, I think, consider that the following represents a proper and conservative basis for comparison; electricity being credited at the highest practical efficiency. The calculations allow an ample margin for general maintenance (and in the case of power, for intermittent running) which ought not at any time be of such a heavy nature as to make up the considerable difference in cost.

Value of the Therm compared with the Electrical Unit.

1. Gas.	2. Electricity.	3. Ratio.	4. Rate per Unit.
			d.
Lighting—			
Inverted burner . . .	Gasfilled lamp	3·0 to 1	3·3
Superheated burner . .	do.	3·8 to 1	2·6
High-pressure burner . .	do.	7·5 to 1	1·3
Inverted burner . . .	Metallic filament lamp	5·2 to 1	2·0
Superheated burner . .	do.	6·5 to 1	1·5
High-pressure burner . .	do.	13·0 to 1	0·8
Heating—			
Gas-fire (70 p.ct.) . . .	Radiator (convector)	20·5 to 1	0·5
Power—			
Gas-engine (75 p.ct. load).	Motor	6·0 to 1	1·6

These figures show a remarkable fuel cost difference. The prices at which current must be supplied to equal the cost of gas for the various purposes detailed (taking gas at 10d. per therm) are given in column 4. The electrical cost for power would in most cases have to be even lower (somewhere about 1d. per unit) by reason of the almost general discount allowed on gas used for this purpose. It is, however, recognized that occasions do arise where fuel cost alone must not be regarded as the determining factor.

I do not for one moment agree that the future of gas for illuminating purposes is the "dead letter" which some would have us think. Certainly, the securing of gas for lighting in new buildings is sometimes difficult; and, despite much improved efficiencies, artistic fittings, distance-control devices, and other (to our knowledge) considerable advantages of gas, there is a desire by some sections of the public for electricity. The reasons advanced for its selection are oft-times somewhat obscure, but, so far as we are concerned, effective. One cannot disguise the fact that these conditions do exist; and, except in dwellings of the artizan class, the introduction of gas for lighting purposes is more difficult to obtain than heretofore, and requires considerable energy on the part of those who come into contact with the consumer. In the case of new buildings erected for sale, the opportunity of interviewing the actual user of gas is remote; and I am afraid the average builder, despite close attention to his requirements, thinking only of cheapness in constructional cost and the elimination of anything which may savour of luxury, holds the view that wiring, at least for lighting, is the correct thing to do. It is somewhat surprising to note how often a potential purchaser shows a penchant for electricity. I do not think any good purpose is served by disguising the fact; it should serve to stimulate effort.

Distribution departments cannot expect to obtain every load; and one of the methods adopted by the author and many others is to see that, where the lighting is not to be done by gas, at least one piece of gas-consuming apparatus is installed over and above the usual cooking range and fire. Consumption is thereby maintained at a good average figure. In instances where lighting is "turned over," strong representations are made in the direction of introducing additional appliances; and in these cases drop in consumption is negligible—indeed, the account often rises. The period during and immediately succeeding the war was a time when great expense was entailed in the provision of the necessary mains and services for the large number of State (and now, I am afraid, rate) aided housing schemes. In some instances, engineers were fortunate enough to obtain grants-in-aid; but the distribution of these very useful reliefs did not come the way of all undertakings. A large amount of capital has been sunk in meeting requirements; and it will be some years ere consumption will justify expenditure. However, the business had to be faced, and right well was it done.

How best to increase consumption at the lowest possible capital cost is a very important question. So far as coin consumers generally are concerned (and the majority of tenants on housing schemes burn gas through this type of meter) a solution is offered by the adoption of small gas-fires loaned without cost to all approved slot consumers. The capital cost is small, and where assurance is obtained that the fire is to be properly utilized (*i.e.*, that it is only installed in a certain room), the increased consumption would doubtless justify its introduction, in addition to which the apportionment of the charge difference for the extra gas used between ordinary and slot meters (calculated on an average consumption basis) should form some return on capital. When we consider the great use made of gas-consuming appliances—the hard wear to which a cooker is subjected, for instance—complaints cannot be said to be numerous; and we should actually encourage the consumer to "write in" with regard to all apparatus. Even with a yearly inspection of fires, cookers, geysers, &c., the chance of something going wrong is not remote; and attention at once is likely to save considerable future expense and annoyance to consumers. Many complaints may be regarded as unnecessary. In this class we may include those arising from the "cheap" burner—badly made, it soon burns out and becomes defective. The gas office is communicated with, and the fitter who attends can make only a temporary repair, if any. A scheme which is achieving considerable success is in operation in the author's district. Attention was drawn to the large number of complaints of this type; and it was decided to adopt a high-class inverted burner, and place it before the slot consumer at a trifle less than cost price—the fixing being done free. It is thus hoped to diminish the complaints arising from this nuisance; and already consumers are appreciating the advantage of the new burner. It is certain that by the adoption of a policy on these lines, and its large-scale reception by the consumer, any little loss occasioned by the supply of the burner on these special terms is more than counterbalanced by the reduced number of calls which will in future have to be made by the complaint fitter. A small complaint record is no criterion of the satisfaction of the consumer or the efficiency of the distribution department. Indeed, to use an Irishism, "'Tis the complaints we don't hear about that require our attention."

Every undertaking has a distinct duty to its consumers, especially with regard to apparatus on hire. Very little attention is given by users to cooking and heating stoves, lighting fittings, &c., and these are expected to render efficient service year after year. Who has failed to notice dirty, inefficient burners and fires, broken or misplaced radiants, &c., in districts throughout the country? A means, therefore, for retaining existing appliances and ensuring satisfaction lies in periodical maintenance, without charge, except perhaps where lighting fittings are concerned, where, in the author's opinion, the charge should be confined to materials used; the same rule applying to consumers' own appliances. The financial aspect must, of course, be considered; and it may be asked where the money to carry out such proposals is to be obtained. The obvious reply is that, unless the industry gives this service on the very best terms to the consumer, progress will be stultified, and the securing of that large share of necessary domestic expenditure, which all are optimistic enough to expect, will be considerably deferred. I am aware that certain undertakings have schemes in operation, but the practice is by no means general.

The class of man coming into contact with the gas user is undoubtedly of a higher standard than heretofore; but with certain exceptions, where the larger undertakings have taken in hand the tuition of their staffs, the industry is by no means overburdened by a superabundance of technically-trained men. The demands made upon the intelligence of the average gas officer are many; and a fairly extensive knowledge at least of such subjects as illuminating engineering, heating, domestic gas-heated hot-water supply problems, the uses and limitations of power units, &c., is required to give the best service to company and consumer. How often is one faced with a problem about which the questioner has a fairly accurate idea? It is refreshing to note, therefore, that the industry now realizes the need for the highly-skilled technical officer; and the new Education Scheme of the Institution of Gas Engineers must in its application, and after an interval of a few years, produce the right type of man for future requirements. The industry has already in its ranks very capable and worthy young men and others whose abilities perhaps lie dormant for want of encouragement; and it is up to those who occupy administrative positions to encourage in every way young members of their staffs properly to equip and qualify themselves for the higher positions in the profession, which can in the future only be held by trained individuals. In the author's judgment, certain financial aid and time allowance should be given to those of merit, and a prospect of advancement and financial advantage, accruing in the same undertaking, held out as a result of effort and success. I have great hopes that engineers and managers will follow very closely the new scheme, and in every way support it. It has been born none too early, and will, without doubt, influence the prosperity of our business in a manner only to be judged by those who can visualize future conditions likely to arise in the industry.

The psychological aspect in business must not be lost sight of. The individuality in (say) the chief of a department is largely reflected in the conduct and assiduity of those working under his direction; and efficiency of control is considerably influenced by his manner, quickness of decision, and example. Firmness allied to sympathetic consideration is conducive to loyalty, and obtains for the undertaking the confidence of the employee and the removal of any feeling that he is merely an impersonal cog in the business machine. Personality counts largely on the district, and produces good relations between buyer and seller; but the personal element alone is of little value. A business-getting department such as is now being considered must always be greatly influenced by the man at the head, whose character finds its reflection in those who operate under him.

Many more features and points arise in the consideration of methods and means, based on economy in operation and simplicity of organization, for the proper and efficient conduct of a distribution department. Of all sections of an undertaking it is, perhaps, the most important, inasmuch as its officers are those who are in actual contact with the consumer. By their conduct, appearance, and ability they are known, and the undertaking judged; and the impression created by representatives and officers combining with these attributes real technical knowledge is of a most excellent character, and makes for any undertaking valuable material whereby its prosperity may be determined.

In the foregoing notes I realize that I have touched upon principles no longer, perhaps, in the theoretical stage with many undertakings, but I have endeavoured to create one or two points worthy of attention; and if in this I have been successful, my object in presenting this paper will have been fully served.

Discussion.

The PRESIDENT (Mr. Percy S. Hoyte, of Plymouth) thought there was no need for Mr. Chandler to apologize for the brevity of his paper; for what it lacked in length it had made up in the very sound propositions which it contained. One thing that must strike all of them was the statement made at the beginning of the paper—"the main point now to be considered by the industry is the cheapening of the therm, to make town gas the one and only fuel, by the adoption of which those very desirable results outlined by Dr. Saleeby may, in common with many other economies, be effected." Those of them who came from Devon did not often have an opportunity of tasting what a London fog was like; but they had had such an opportunity on this occasion, and very disgusted they were. All of them were doing everything possible to reduce the price of their gas, and so make the distribution departments more effective; but there was, he feared, no royal road to the cheapening of the therm. They were dependent upon the coal and residuals markets, and so forth; but Mr. Thorman's paper had shown them one of the economies that could be effected on a gas-works. He hoped that at no distant date they might find themselves in a position as regarded cost absolutely to compete with, and to drive out from their midst, the coal fire.

LOOK AFTER THE CONSUMER.

Mr. SAMUEL GLOVER (St. Helens) said that, in the meantime, he thought it must be admitted that every distributing engineer who did his work in accordance with the principles laid down in Mr. Chandler's paper was helping to reduce the therm price. He did not mean *per se* necessarily, but to the consumer. This was Mr. Chandler's point. While he emphasized the importance of the therm being produced at the works at such a price as would help him, he said, and quite correctly, that the distribution side of the industry had now become as important as that of manufacture. All the time they had to work together. In many cases therms were followed to the meter, but they did not follow them to the burner, and the consumer was not getting the advantage of the actual price at which the therms were being sold to him wholesale. He thought Mr. Chandler had been right to emphasize this point. They had to apply this principle right down to the smallest undertakings. It was perfectly true that there still remained an enormous amount of work to be done in this direction. Certainly more was being done now than formerly. It was quite true that they did a great deal of following to the tip of the burner, and allowing the gas to display its efficiency right through; and this paid in the end. It increased the demand for gas, to the benefit of all concerned. Also, it was a national duty to do all they could to see that gas was used in an efficient manner. Look at the enormous lengths to which some electrical departments would go in distributing current to the houses of the working classes, and the enterprise they were putting into their distribution generally. Gas companies should emphasize the duty to the nation they themselves were performing, so that the position should not come about in which the whole of the business classes in our cities and towns could be controlled by a few men who distributed electricity, and the entire economic and social wellbeing of the people could be threatened by a section of the community. Gas companies should do their duty by every consumer in the efficient manner that Mr. Chandler had impressed upon them that afternoon. Indeed, it was becoming more and more incumbent upon them to do so.

Mr. W. W. TOWNSEND (Colchester) wished to express his appreciation of the paper. He did not think any District Association meeting now ought to pass without discussion of the topic of distribution and sales. It was just as important that they should distribute and sell properly as that they should manufacture properly. Looking at the table accompanying the paper, he could not find any figure of the cost at which the author had taken electricity. For power, the ratio was given as 6 to 1 in favour of gas; and if this meant that the electrical power was taken at six times 1·6d., it seemed rather a high rate.

UNEMPLOYMENT GRANTS COMMITTEE.

Reference was made by the author to the unemployment question, and use being made of this in some cases in the way of grants, State aid, &c., for assisting housing schemes. He would like to draw attention to the fact that the Unemployment Grants Committee were rather anxious to get gas undertakings to help by putting work in hand. He (Mr. Townsend) had had some correspondence with the Chairman of the Unemployment Grants Committee under the late Government, Sir Worthington Evans, and had pointed out that the terms of the

offer were not attractive to gas undertakings. He was then asked what terms would be attractive, because the matter was coming again before the Committee, who were anxious to get undertakings to put such work in hand. Of course, the General Election was holding everything up now; but when this was over, it would be a very good thing if a number of undertakings—apart from bodies like the National Gas Council—who were prepared to put work in hand would decide what terms they were prepared to accept. He thought 60 p.ct. of the labour charges would be the best way of dealing with the matter, because in many cases it was not necessary to raise capital. Local authorities were obtaining 60 p.ct., which was enabling the gas industry's competitors—who were largely municipal undertakings—to extend their cables in directions in which they would not have thought of going years ago. In fact, they had got in a great push by means of Government grants, and were going to compete with gas. Mr. Chandler spoke as if a lot of capital had been sunk by gas companies in meeting requirements for housing schemes; but this was not the case throughout the country. There was a large number of cases—and he thought it was a very bad thing—where there was no gas yet available for housing schemes, and opportunity should be taken of such proposals as the Unemployment Grants Committee might make to get gas introduced. He noticed the author had adopted the policy of fixing a high-class inverted burner for slot consumers at a trifle less than cost price—the fixing being done free. It seemed rather surprising that he did not go the "whole hog," and give the inverted burner. He did not see why a slot consumer, who paid 10d. per 1000 c.ft., or 2d. or 3d. per therm, extra, should be asked to pay for appliances for using gas; and it was well to provide one or more burners free. He had got every one of the housing schemes in his own town for gas exclusively, and was paid for the piping, but he put incandescent burners in all rooms free, and had been well rewarded. There was now no demand for electric lighting, such as there was originally; the tenants being well satisfied with gas. The houses were distributed over a long tract of country. The Gas Company were able to put in cookers and wash-boilers, thus making a profit where other undertakings would probably have incurred a loss. There was another point which was no doubt controversial, but he personally was glad to note that the author said, where maintenance was concerned, the charge should be confined to materials used. This, in his opinion, was the crux of the whole matter. If they wanted to retain lighting, and a great deal of the heating, it was necessary to carry out maintenance, so far as labour was concerned, free. The consumer would not pay a small sum for this service, but he would have it free, and in the long run there was no doubt it paid.

Comparative Costs.

Mr. P. G. G. Moon (Bournemouth) said the paper was one of broad principles, perhaps, rather than detailed considerations, and it was one possessing the width of outlook which one would expect from a responsible official in so progressive an undertaking as that at Tottenham. He was glad to see the table, in which the author very wisely made use of the new standard—the therm. They had done the same thing at Bournemouth, but perhaps on rather simpler lines, as a beginning, though these simple lines could be extended to broad applications. One required practically 30 electrical units to give the equivalent of a therm, and therefore each 1d. per unit in the price of electricity meant 2s. 6d. per therm. Thus at Bournemouth, where the lowest price of electricity was 2½d. per unit, they had a comparison of 8·4d. per therm for gas, and 6s. 3d. for the same heat units from electricity. This was a broad statement which the average lay consumer could readily understand. One could carry the matter further, if required; but usually they found the comparison so striking that any elaboration of details was unnecessary. The therm basis gave them an excellent selling medium for their undoubtedly cheaper commodity, and they must take the fullest advantage of it. It was gratifying to find that the author emphasized the desirability of seeking for complaints. Theirs was an industry out to serve the community; and the measure of their success was the real service they were able to give consumers. If consumers were dissatisfied, then they were not giving the fullest service. In their own interests, also, they wanted to know of any dissatisfaction, so that the matter could be put right. Therefore it was a sound policy to seek complaints, in order that they might be remedied. This could not be too much emphasized.

Mr. T. Hardie (London) said, after reading papers on this subject lately, it rather seemed to him that the distribution department were losing sight of their work, which was distributing gas. He would therefore put forward the suggestion that a lot of their troubles could be got over, and expenditure would not be nearly so great in this regard, if they would convey the gas to the consumers at a pressure at which their apparatus would work consistently. To his mind, this was the most important point for the distribution department. The maintenance of apparatus could very largely look after itself, if there was no variation in pressure.

Mr. H. J. Randall (York Town) said all of them, and particularly those in charge of the smaller undertakings, were indebted to Mr. Chandler. Referring to the Salesmen's Circles, he remarked that at these meetings much valuable information was obtained, which he was sure was having a very good effect upon distribution generally.

Mr. D. T. Livesey (East Grinstead) pointed out that not long ago the industry was subjected to a newspaper agitation against the therm, which raged for a considerable time. From his own observation, he was glad to note a change from this attitude; for he had just seen in the daily Press an article advocating the use of gas in order to stop London fogs.

Cheapness Not the Only Point.

Mr. W. M. Mason, of the British Commercial Gas Association (called upon by the President), said it was only to be expected from an Association like the Southern, which was perfectly organized, that a paper like Mr. Chandler's should be submitted from time to time. Such a subject should be discussed regularly at these meetings; for it affected the whole public in a very practical way. While it was absolutely necessary that troubles on the works should be rectified, it was equally essential that the consumers should be satisfied. Mr. Chandler had rightly pleaded for a satisfied consumer; but a satisfied consumer sometimes did not know that he ought to be dissatisfied. What they needed to do was to go out and find the consumer who had reason to be dissatisfied. It would pay well. Another point. He did not believe that the finest thing in the gas industry was cheap gas. The members of the Association did not smoke the cheapest cigarettes; they did not go to the cheapest hotels in London; they did not invariably travel third class; and they did not always wear the cheapest clothes and the cheapest boots. The thing that was needed in the gas industry to-day was salesmanship. Salesmanship made the dissatisfied consumer want to get something he had not got yet—want, for example, to get a gas-fire in place of a filthy coal fire. The cheapest gas was not the solution of the problem, but the education of the people to the wonderful possibilities of gas. The thing was to educate. Electricity was not cheap, but some people would have it if it cost ten times as much. What the industry needed to say was that gas, from an efficiency and health point of view, even if it cost ten times what it did, would be good value.

The President felt that he had been misunderstood by Mr. Glover and Mr. Mason; but he did not think Mr. Chandler had misunderstood him. He had no intention whatever of depreciating the work of the distribution department or salesmanship; but where gas was sold in the neighbourhood of 1s. per therm, or more than that, it must make the work of propaganda extremely difficult, however well the apparatus might be maintained. He did not by any means pose as an apostle of mere cheapness; but the cheaper they could produce their gas—of course, combined with efficient salesmanship—the more would they be furthering the interests of the industry.

The Author's Reply.

Mr. Chandler expressed his pleasure at the reception accorded the few notes he had put together. Mr. Townsend had asked the price of electricity in connection with his table. It was simply a case of working back. He had taken gas at 10d. per therm, and had shown in the last column the price at which electricity would have to be charged to compete with gas. At 10d. per therm, the figure was 1·6d. per unit, for power. He was aware that some housing schemes had not an adequate supply of gas; but generally speaking in these cases the gas undertakings were unable, owing to financial difficulties, to provide the necessary mains and services. Hence, unless a contribution came from the authorities, these mains could not go in. He agreed it was very desirable, as far as possible, that the slot consumer should have a full fit-up of fittings and burners; but he was afraid, in the case of his own particular undertaking, that this was not at the moment practicable. They had a very large number of slot consumers, and the cost of supplying them all with inverted burners would be prohibitive. They were supplying meter, cooker, piping, and fittings. As a matter of fact, in the case of certain London County Council houses, and others where they had arrangements whereby a portion of the cost was recovered, they did supply the complete fit-up, including the necessary inverted burner. Mr. Hardie had referred to an important matter in connection with gas distribution—that of adequate pressure. Every engineer would agree that it was absolutely imperative that an adequate pressure should be maintained; and while distributing engineers would be looked to for that, they in turn looked to those on the manufacturing side to supply gas of constant density, and so on. In his own judgment, cheap gas, while not perhaps everything, was of considerable assistance to everyone on the selling side. The question of cost per therm, for instance, was most important when one was discussing a scheme for steam raising by means of gas. The price then was the starting point, and if the gas could not be supplied at a reasonable figure, all other arguments would fail. A low price was a very great lever to the distribution man; and the cheap therm opened-up vast possibilities.

The President said, without proposing a formal vote of thanks, they all appreciated very much the paper and the discussion to which it had given rise.

Mr. W. J. Sandeman (Croydon) writes as follows:

As I was prevented from attending the meeting of the Association, I am sending a few notes in regard to Mr. Chandler's paper.

Mr. Chandler says one of the important points for the industry to consider is the cheapening of the therm, so as to make gas the one and only fuel. We must, however, not lose sight of the fact that the use of gas in a general way for industrial processes is limited by the comparative costs of the unit of heat obtainable in coal and gas. While the ratio is approximately four to one in favour of coal, big industrial demands—particularly for steam raising—for gaseous fuel must remain latent, as this disparity cannot be made up by the saving of labour and the greater thermal efficiencies associated with gas appliances.

The manufacturing side of our industry is primarily responsible for bringing about a reduction in the price of the therm; but the distribution department can do much by adopting a more self-supporting policy, and thereby helping to cheapen the price of gas. Defective organization, subsidies in installation work, loss of remunerative time, &c., must be made up out of the price of gas, and the trading department should, as far as possible, pay for itself. I strongly disagree with giving things away and getting business at any price. The industry is not yet in the condition when people have to be bribed to use gas, and, at the very least, it is a weak policy.

Mr. Chandler points out that the distribution and sales side of our business has now become as important as that of manufacture. I, also, pointed this out in a paper I had the privilege of reading before this Association about two years ago. Yet little or nothing is being done towards the systematic training of men for this important side of our work, nor does the industry offer sufficient inducement to the right type of young man to join its ranks.

In quoting the value of the therm, compared with the electrical unit, I think Mr. Chandler has gone a little too far in claiming 70 p ct. efficiency for the modern gas-fire. From 50 to 60 p.ct. is the utmost I should care to claim.

I agree with Mr. Chandler that the future of gas for illuminating purposes is not the "dead letter" some would have us think. We are, however, at a great disadvantage while we are obliged to retain the use of the by-pass. Switches and automatic lighters have helped

matters considerably, but the inherent drawbacks of the pilot light are still with us.

I have taken out the average consumption per house on all the housing estates in our district, and find that on the estates where gas is used for lighting and cooking, the average consumption is about 34,000 c.ft. per annum, as compared with 29,000 c.ft. per house where electricity is used for lighting and gas for cooking—thus showing that on those particular estates where electricity is used for lighting we lose a consumption of about 5000 c.ft. per house per annum. Although this is a comparatively small amount, the matter is not one that we can afford to ignore.

Mr. Chandler is of opinion that, where lighting fittings are maintained, the charge should be confined to materials used. I am afraid, however, I do not agree with him. I do not think there is the slightest necessity for giving the consumer this service free, so far as labour is concerned; and, further, I do not think that he properly appreciates it. We make a charge of 2d. per burner per visit for labour, and supply materials at ordinary selling prices. We have a staff of from thirty to forty men engaged on this work, and between them they maintain about 80,000 burners. Our experience is that if people want regular burner maintenance, they will not object to paying for it.

The author made no mention in his paper of the steps that his Company are taking to modernize cooking stoves. This is an expensive business; but it is one that must be dealt with promptly, if the gas cooking stove is to retain its popularity.

AUTOMATIC TEMPERATURE CONTROL.

Scientific Apparatus as an Aid to Economy.

In many industrial processes the temperature must be kept within narrow limits if satisfactory results are to be obtained. This may be done by regulating the supply of heat by hand, so as to keep as constant as possible the reading of a thermometer or pyrometer placed in the heating chamber. This method, however, is by no means infallible. A sudden change in the conditions, or temporary inattention on the part of the workman in charge, may result in considerable variations of temperature, and consequent serious loss. Some form of automatic control is therefore necessary, if economy and efficiency are to be secured. At the Shipping Engineering and Machinery Exhibition held last September, we were interested in the simple and effective devices for automatic temperature control which were exhibited by The Cambridge and Paul Scientific Instrument Company, Ltd. A very brief account of the exhibit of this firm was given in the "JOURNAL" for Sept. 5 (p. 680). Since then, more detailed information has been received; and it is thought that a description of the latest developments in the direction of heat regulation will be of more than passing interest to our readers.

Various types of apparatus are made; the decision as to which should be employed depends on the problem under consideration. Each outfit comprises a sensitive element connected to an indicator which is fitted with a device whereby the supply of heat is automatically reduced as soon as the temperature of the furnace exceeds a definite value, and increased when it falls below that value. In gas-fired furnaces, and in processes in which the heat is supplied by steam or water, the device on the indicator operates a valve, either directly or by means of an electric relay, while in electric furnaces it operates a relay controlling the main circuit.

For temperatures not exceeding 1000° Fahr. (540° C.), an index thermometer usually serves as the indicator, and the bulb of the instrument is the sensitive element. Alternatively, a millivolt-meter is used in conjunction with a resistance pyrometer. For temperatures between 540° and 1400° C., thermo-couples are generally used. For higher temperatures the total radiation of the hot body is measured by means of a Féry telescope; while for some applications the telescope is replaced by a thermo-pile. The indicator is fitted with an adjustable contact, which is set to the temperature at which the furnace is to be controlled. When the thermometer pointer reaches the contact, an electrical circuit is closed, thereby energizing mechanism which controls the supply of heat to the furnace. In gas-fired furnaces, closing the circuit either energizes an electric gas-valve or operates a ball relay. The former is shown in fig. 1, illustrating a balanced valve for use with gas or air when the flow passes through a 2-in. pipe.

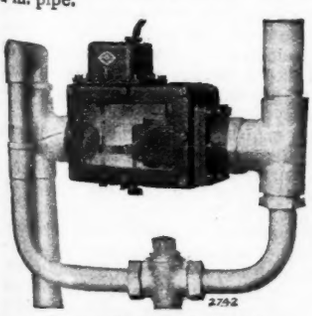


Fig. 1.—Balanced Valve for Low-Pressure Work.

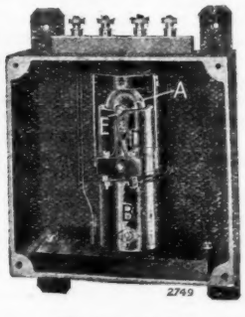


Fig. 2.—Ball Relay Valve.

The valve is by-passed by a cock, so that the amount of gas which it regulates can be adjusted to any proportion of the total. The gas enters a chamber with circular outlets, top and bottom, to the main chamber. Above the outlets are discs mounted on a spindle suspended from one end of a horizontal bar. This bar is pivoted near its middle, and carries at its other end a soft-iron armature which is just below the pole pieces of an electro-magnet. Normally, the weight of the discs and spindle is balanced by a spring, and the valve is open. When the electro-magnet is energized it attracts the armature, and the discs are forced downwards on to their seatings, closing both apertures. For pipes up to 1 in. in diameter a simple ball valve is inserted directly into the pipe line.

The ball relay is illustrated in fig. 2. A glass sphere A, into which two platinum wire electrodes (D, E) are sealed, rests on a bell-shaped magnet B, consisting of a hollow steel sphere. When the magnet is energized, this sphere is pulled downwards, and the mercury squeezed out laterally, thereby closing the previously open circuit between the two electrodes. Closing the circuit either operates a valve or energizes a circuit breaker in the main circuit.

For temperatures up to 2553° Fahr. (1400° C.) a high-resistance moving coil galvanometer fitted with a calibrated temperature scale may be used. It is connected to a sensitive element, which may be a resistance thermometer, thermo-couple, Féry telescope, or thermo-pile. Near the end of the pointer is attached a light thermo-couple electrically connected to a moving-coil relay. A small electrically heated coil is set to the point on the scale at which it is desired to control the temperature. When this temperature is reached, the thermo-couple on the pointer is brought opposite to the coil, and becomes suddenly heated; the electromotive force thus set up energizing the relay, and so completing an electrical circuit which operates mechanism controlling the supply of heat. As soon as the temperature falls, the thermo-couple leaves the coil, and the process is reversed. The accuracy of control depends on the openness of the scale, and the sensitivity of the element. With a suitable combination of indicator and element, an accuracy of 0·3 p.ct. can be obtained for temperatures not exceeding 800° C.

If very quick control of temperature is required, a three-contact relay is usually employed. In this, three platinum wires are sealed into a glass tube containing mercury. Normally, the position of the tube is such that electrodes are covered by the mercury, thus completing a circuit which closes a valve. As soon as the temperature rises to a certain figure, a solenoid is energized, causing the tube to be tilted. This makes the mercury flow to the other end of the tube, thereby breaking the circuit and opening the valve. In applications where the pressure is more than 10 lbs. per sq. in., and the flow passes through a 1-in. pipe, a balanced valve of special construction is used. This is operated by means of an iron core moving inside a solenoid. When the latter is energized, the valve is closed. It will control a flow at a pressure of 40 lbs. per sq. in.

A standard outfit for controlling the temperature of gas-fired furnaces is shown in fig. 3.

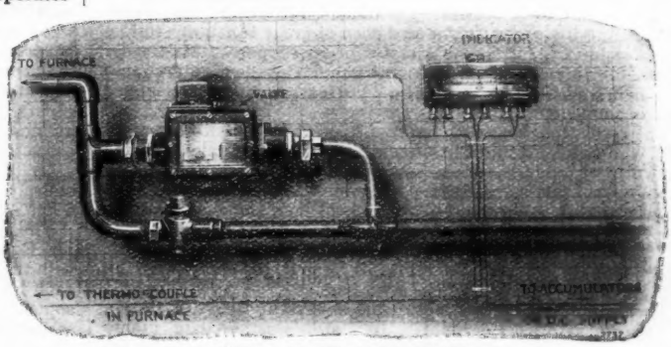


Fig. 3.—Complete Apparatus.

It consists of an indicator connected by a length of leads to a thermo-couple so placed in the furnace that it gives a true indication of the furnace conditions. The type of thermo-couple used depends on the temperature of the furnace. The moving-coil relay, which is contained in the indicator case, is connected to a balanced valve. With this outfit it is possible to control the temperature to within 1 p.ct. of the indicator range.

Curious Deposit in a Gas-Main.—"An Interesting Underground Deposit" was the title of a lecture given by Mr. Arthur Marsden, Chemist to the Bristol Gas Company, before the members of the South-Western Section of the Institute of Chemistry, at the University College, Exeter. Mr. Marsden explained that the deposit occurred on the outside of a hot gas-main at the Bristol Gas-Works, and was due to a mysterious formation of calcium acetate along the main for a distance of 20 ft. There was no trace of leakage from the main, which was embedded in marl. The source of the organic matter for the bacterial production of the acetate was difficult to trace, but Mr. Marsden was of opinion that it was matter carried along by percolating water.

MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

THE Autumn General Meeting of the Midland Association of Gas Engineers and Managers was held at the Grand Hotel, Birmingham, on Thursday last. Mr. P. N. Langford (Coventry), the retiring President, occupied the chair; and the attendance was thoroughly representative of the Midland District.

Apologies for absence were read from Messrs. J. R. Duff (Banbury), W. E. Caton (Oxford), Saml. Glover (St. Helens), and J. Wilkinson (Nottingham), and from the Presidents and Secretaries of kindred Associations.

MEMBERSHIP.

The meeting approved the election of a new member—Mr. Alfred Blakemore, of Ledbury.

The Committee recommended the election to honorary membership of Mr. B. W. Smith, of Walsall.

The PRESIDENT said it gave him the greatest pleasure to move the adoption of the Committee's recommendation. Mr. Smith had been a member of the Association for 41 years, and as long ago as 1893 occupied the Presidential Chair. His record of service during that long period had been a source of inspiration to all of them, and richly deserved the honour it was proposed to confer upon him. He hoped he would long continue to favour them with the benefit of his ripe experience and wise counsels. ("Hear, hear.")

Mr. J. PATERSON (Cheltenham) seconded the resolution, observing that the name of their old friend, Mr. Smith, stood pre-eminent in the Midlands. They knew him as a capable engineer and, personally, as a man of a charming and endearing nature. As an honorary member he would enhance the reputation of the Association. Many years ago he passed through the Presidential Chair. He had been a faithful friend of the Association, and he had enriched their debates. They were honouring themselves in honouring him.

The recommendation was approved amid applause.

Mr. B. W. SMITH, in reply, said he was overwhelmed by the kind remarks that had been made, and by the position in which they had placed him. He accepted it with great pleasure. They had conferred one of the biggest honours they could upon an old member of the Association. He had done with much pleasure what he could for the Association, and he was only sorry that "A.D." had stepped in and caused his retirement from the lists. He hoped to continue to attend their meetings, to hear the discussions, and, may be, sometimes to take part in them. ["Hear, hear."]

ELECTION OF OFFICERS.

The PRESIDENT stated that the Committee had made their recommendations for the election of officers for the ensuing year. They submitted the name of Mr. C. H. Carder, of Oldbury, as President. As they knew, he had done excellent work for the Association during the past few years—particularly with regard to the labour side of their activities. No one, unless closely connected with that work, could realize the amount of time and thought he had expended to further the interests of the Midland Association of Gas Engineers in the matter of labour. Acting as Vice-President during the past year, he had been of great assistance to him [the President], and he was grateful for his support. Mr. Carder would fill with distinction the position of President, and uphold the high traditions of the office. ["Hear, hear."] He moved the recommendation.

The resolution was seconded by Mr. R. S. RAMSDEN (Leamington), who observed that Mr. Carder's worth was principally made known to them as the Hon. Secretary of the Federation of Gas Employers. His work in that connection was invaluable, because he was able to advise and instruct them in a statesmanlike and thoroughly practical way.

The resolution having been unanimously carried,

Mr. CARDER thanked them for the honour, repeating what he said when he was elected Vice-President: "I will do my best."

Thereafter, Mr. CARDER moved the election of Mr. W. E. Caton, of Oxford, as Vice-President. Mr. Caton was, he said, highly esteemed for the great amount of work he had done, and also for the energy and ability he displayed.

Mr. C. H. WEBB (Stourbridge) seconded, and the resolution was approved.

Messrs. C. R. Armitage (Newcastle), F. Shewring (Stratford-on-Avon), and C. F. W. Rendle (Redditch) were appointed members of the Committee to replace Messrs. W. E. Caton, E. L. Adlington (Worcester), and W. G. S. Cranmer (Willenhall), who retired.

Messrs. Harold Davies (Chesterfield) and A. Roberts (Hereford) were appointed Auditors, and Mr. T. Thornton (Rowley Regis) was re-elected Hon. Secretary. In seconding a resolution making these appointments (proposed by the PRESIDENT), Mr. CARDER bore testimony to the splendid service rendered to the Association by Mr. Thornton.

THE EDUCATION SCHEME.

The PRESIDENT informed the meeting that the Education Scheme had received a great deal of attention from the Advisory Committee and from the Institution of Gas Engineers; and it was accepted last February by the Institution. A subsequent meeting of the Advisory Committee was held, when it was decided that the scheme should be brought into operation during the session 1923-4. They had issued an appeal that the members of the Senior Associations should do what they could to co-operate with them in making the scheme a success. They indicated two lines upon which such co-operation might be carried out. One was that they should do their utmost to impress upon the members of their staffs the importance of technical training, and to instil into their minds the need for taking advantage of the facilities that would be provided under the scheme. The other point was that engineers and managers should use their influence with their respective boards or committees so that the students would, where necessary, be allowed time off from their duties to attend day classes, and also that they should endeavour to obtain for them financial assistance in covering the cost of the education, travelling expenses, and the like. Such expenses were often a serious matter to young students. It would be to the interests of gas undertakings that they should do what they could so that the young members of their staffs might acquire sound technical knowledge. They would later reap the advantage of the knowledge thus obtained.

Mr. RAMSDEN inquired if any scheme had been prepared for the Midlands. Had any special classes been formed at Birmingham or Coventry?

Mr. F. C. BRIGGS (Dudley) had made inquiries. He had found that not even in Birmingham had any definite scheme of classes been formulated. He hoped the new President would use his influence with the Birmingham Education Authorities, so that during the next session a proper series of classes, special to the gas industry, might be provided.

Mr. G. HELPS (Nuneaton) asked if there were any set text-book that would more or less govern what the students were to be taught. He recently came across a book containing "5000 fallacies." A text-book on the fallacies in the gas industry would afford much help to students; such a book would be of the greatest possible value. There were many fallacies gaining ground in the gas industry. Personally he did not know of any set of text-books that would carry students far. The gas industry was young, and there were many problems to be dealt with.

The PRESIDENT, replying, pointed out that the Junior Associations were taking up the matter with headquarters. As to a text-book, they would be grateful if Mr. Helps would write them one. [Laughter and approval.] Several good text-books were to be recommended.

JOINT TRANSACTIONS.

The next business was to consider the question of the republication of the "Joint Transactions of District Associations."

The PRESIDENT said it was to be regretted that publication of the "Transactions" had been discontinued. The Committee had considered the matter, and felt that the time had come when they should resume it. The "Transactions" were absolutely invaluable as a work of reference. They appreciated the publication when they desired to look up some article which they had read years ago; it meant hunting through all their journals, and often they could not put their hands upon it. The matter had been considered by other Associations also, and he thought that, generally, republication would be adopted, which would involve an increase in the amount of subscriptions. In the majority of cases the subscription would be a guinea.

Mr. PATERSON asked whether a subscription of a guinea would entirely cover the cost of distributing the copies. Were also other Associations coming into line on the same basis?

The SECRETARY stated that the question had been taken up by Mr. Rogerson (Secretary of the Manchester District Institution) with the "GAS JOURNAL." He had the definite price of 9s. 6d. each for a guaranteed number of 750 copies, and 8s. 6d. for 1000 copies. The Manchester Institution had decided to increase their subscription to a guinea, in order that each member might have a copy; Wales and Monmouth had done similarly; and he believed the Southern Association also favoured the proposal. Their own suggestion was that the annual subscription be advanced to 15s. for members having control of works making 50 million c.ft. or less per annum, and to one guinea for all other members. They calculated that with 108 members the increased subscriptions would bring in £33 towards the £51 for the "Transactions;" this would mean that the Association must find £18.

In reply to Mr. H. POOLEY (Leicester), the SECRETARY observed that last year the Association had a surplus of £30, costs being down; and they had voted 10 guineas to the Benevolent Fund and 10 guineas to the Emergency Fund.

Mr. H. DAVIES (Chesterfield) said it was desirable to make a definite guarantee, so as to get the most favourable terms.

In Mr. POOLEY's judgment, the Association were to be congratulated upon the fact that subscriptions had not been increased, except for the Emergency Fund. Every other Association with which he was connected had done so, and often considerably. They were prudent at the time they withdrew from the "Transactions," because they were unable to meet the publishers' costs, but many of them had keenly felt the loss of them. He thought the present time was a good opportunity to raise sufficient money to make up the difference, by which they could again have the

publication. He would give notice to move the following motion at the next meeting:

That in order to provide annually with a copy of the "Joint Transactions of District Associations" each member whose previous subscription has been paid, the annual subscription shall be advanced to 15s. for members having control of works making 50 million c.ft. of gas or less per year, and to one guinea for all other members. That Rule 13 be amended to read as follows: The annual subscription to be paid by each member having control of a works making 50 million c.ft. of gas or less per year shall be 15s., and for all other members £1 1s., payable in advance on Jan. 1 each year, 2s 6d. of the subscription to be credited to the Emergency Fund.

PAPERS READ.

The meeting then turned to the consideration of the following two papers: "The Working of the 'Simplex' Water-Gas Plant (Blue and Carburetted) in connection with Horizontal Retorts," by Mr. H. Haddock, of Atherstone; and "Recent Alterations and Extensions at Hereford Gas-Works," by Mr. A. Roberts, of Hereford. These papers, with the ensuing discussions, follow this paper.

A discussion on coke sales followed, having been initiated by a communication from the Midland Commercial Gas Association.

The meeting then terminated.

THE WORKING OF THE "SIMPLEX" WATER-GAS PLANT (BLUE AND CARBURETTED) IN CONNECTION WITH HORIZONTAL RETORTS.

By H. HADDOCK, of Atherstone.

[A Paper presented to the Midland Association on Nov. 29.]

My reasons for installing a water-gas plant at the Atherstone Works were a shortage of holder capacity and in order to reduce the cost of manufacture.

The "Simplex" blue and carburetted water-gas plant was erected in March, 1922, and has given complete satisfaction. It consists of a rectangular generator, built entirely of firebrick and below ground level. The latter condition means an ideal position for convenience in charging the furnace, and also brings all valves and connections within easy reach of the operator. The producer has a capacity of 1 ton of coke.

The off-take is in the form of an ascension pipe, with arch and dip pipe connected to a hydraulic main. The stack valve is a heavy steel plate bedded on to a thick asbestos seating on top of the ascension pipe; and the cone gas-valve fits the turned and chamfered end of the dip-pipe. On the off-take of the hydraulic main a seal-regulating valve is arranged, by means of which a level gauge can be maintained in the generator regardless of the pull on the foul main. No difficulty has been experienced at this point during eighteen months' working.

A minimum pressure is maintained in the generator, securing as much CH_4 in the gas as possible, there being no degradation of hydrocarbons by secondary reaction; and as far as my knowledge extends, it is the only water-gas plant operating on these lines. A Sturtevant high-pressure fan supplies the blast at 14 in.; and steam is supplied at any pressure from 40 to 60 lbs., a superheater being arranged in the generator.

OPERATION.

The operation of the plant is extremely simple, as all the valves are connected to a shaft conveniently placed in front of the producers, and are worked by a single hand-lever. The gas valve on the dip pipe and the steam valve automatically close when the air blast and stack valve are opened. On the lever being reversed for the make, the blast and stack valves close, and the gas and steam valves open. The blow occupies 5 minutes, and the make 15 minutes.

ENRICHMENT.

The carburetting is by tar only, no oil being required. The carburettor consists of a small cylinder without any fittings; and the tar is blown-in at the top by superheated steam in the form of a spray from the atomizer. The ascending hot gases, picking up the lighter oils, pass to the foul main; and the residue in the form of dehydrated tar is taken off to a seal pot.

The furnace is fitted with a "Sydenham" grate, and no clinkering is required; the fire being pricked-up every three hours. The coke required to fill up the generator averages 2 cwt. for each run of 3 hours.

The plant is worked from 7 a.m. to 1 p.m., and from 3 p.m. to 9 p.m.; the gas passing direct to the foul main of the horizontal settings. No relief holder is necessary.

WORKING RESULTS.

Figures for 1921 and 1922 show that by working the "Simplex" plant the coal carbonized fell from 1955 tons to 1718 tons; the total make of 500 B.Th.U. gas rising from 28,074,000 to 29,798,100 c.ft., and the make per ton increasing by 2923 c.ft.

	£	s.	d.
Coal saved—237 tons at 35s.	414	15	0
Wages saved	86	0	0
	£500	15	0

GAS ANALYSIS.

15 Minutes' Run of "Simplex" Water-Gas Plant.

—	First 5 Minutes.	Last 5 Minutes.	Mixed Gas.
	P.Ct.	P.Ct.	P.Ct.
Carbon dioxide	2·95	6·50	3·75
Unsaturated hydrocarbons	0·10	0·00	3·15
Oxygen	0·20	0·00	0·20
Carbon monoxide	43·5	38·9	22 5
Hydrogen	45·0	52·6	46·1
Methane	3·75	1·0	18 0
Nitrogen	4·5	1·0	6·3
	100·00	100 00	100·000
Calorific value (gross)	323 B.Th.U.	303 B.Th.U.	472 B.Th.U.

Discussion.

The PRESIDENT warmly acknowledged the help of Mr. Haddock in coming forward to contribute a paper. It was not easy to induce many members to do so. The paper was extremely interesting, and the statistics showed that the plant was a great success. Unfortunately, however, the figures that influenced the balance-sheet, as between the coal gas and the water gas, were not forthcoming. He would have thought the intermittent working caused trouble on the district by changes in calorific value; but Mr. Haddock appeared to work to 500 B.Th.U.

Mr. F. SHEWRING (Stratford-on-Avon) congratulated the author, observing that for small works the plant appeared to offer some advantages. He was surprised that a calorific value of 500 B.Th.U. was obtained. His own experience of carburetting with tar had not been successful. Carburetting had the effect of taking out the light oils; and it was clear that a lot of tar would have to be used to obtain really effective results.

Questions relating to the working of the plant, diagrams of which were shown, were asked by Messrs. W. S. MORLAND, F. S. BRIGGS, H. DAVIES, T. H. POULSON, and G. HELPS, and answered by Mr. HADDOCK, to whom a hearty vote of thanks was passed, on the motion of Mr. CARDER, seconded by the PRESIDENT.

RECENT ALTERATIONS AND EXTENSIONS AT HEREFORD GAS-WORKS.

By ARTHUR ROBERTS, Hereford.

[A Paper presented to the Midland Association on Nov. 29.]

In the early part of 1917, we were, in common with nearly every gas-works in the country, faced with an acute shortage of labour, owing to the exigencies of war; and there was the possibility of having to restrict our output. It therefore became a matter of vital importance to obtain a permit to purchase stoking machinery. Tenders were invited from all the leading makers; but, before my Committee had reached their decision, an advertisement appeared in the "Gas World" under the name of a well-known Yorkshire gas-works, offering for sale De Brouwer machinery in two units, and suitable for 3-tier benches. I might mention that our gas-making plant then consisted of 8 benches of eights, Klonne settings, 22 in. by 16 in. ⏢ retorts with stop ends, 9 ft. 7½ in. long, back to back, and arranged in three tiers —2, 3, and 3 retorts.

STOKING MACHINERY.

We entered into negotiations with the sellers of this machinery, and effected the purchase in June, 1917. A mechanic and a labourer were despatched from our works to dismantle this plant; the work occupying from three to four weeks. The whole was then despatched to Hereford in coal wagons. The same mechanic assembled the machinery in our retort-house, and did all the necessary electrical wiring; the plant being brought into successful operation in October of the same year. During the erection of this machinery, the backs of the retorts in three benches were cut out, to convert the retorts into "throughs." The remaining five benches were dealt with during the summer of the following year. This machinery has given, and is still giving, every satisfaction. Its installation, however, did not entirely solve our difficulty, since the coke had to be handled in small hand-drawn barrows. In December, 1918, a contract was placed with Messrs. Herbert Morris, Ltd., of Loughborough, for the supply and erection of a complete electrically-driven telpher plant for coke handling. As the retort-house is low, it did not permit of a very high track; but the latter has proved high enough for our requirements, for, under normal conditions, we do not carry a large stock of coke. The telpher plant was brought into operation on Aug. 4, 1919, and since that date the retort-house work has been carried out in two 8-hour shifts per 24 hours, with an interval of four hours between each shift, instead of three 8-hour shifts per twenty-four hours, as formerly was the case. During the first twelve months we experienced excessive wear of the pinions and bearings on the telpher trolley, due to coke dust; but, by covering in as far as possible all moving parts, and lowering the quenching tank, this has been considerably reduced.

NEW GASHOLDER.

Having to some extent modernized the gas-making plant, the next consideration was the erection of an additional gasholder. The two existing holders were capable of storing 580,000 c.ft.,

while the maximum output per 24 hours exceeded 700,000 c.ft. This question was brought to a head in December, 1919, when the Disposals Board of the Ministry of Munitions advertised the sale of two 500,000 c.ft. spiral-guided holders, without tanks. These were new, and were lying at the makers' works (Messrs. Saml. Cutler and Sons, Millwall). Our offer for one of these holders was submitted, and eventually accepted. We entered into a contract with Messrs. Cutler, to supply a suitable steel tank and erect the holder complete on our foundations. Trial holes were excavated on the proposed site, to ascertain the nature of the ground; and this resulted in the laying of a concrete foundation varying in thickness from 3 ft. 6 in. to 4 ft. 6 in. Work on the foundation was commenced in February, 1920, and completed by early June. Erection of the holder and tank immediately followed. In August, 1921, the holder was inflated for testing, and successfully brought into service during the following month. The inlet and outlet pipes are 24 in. in diameter.

HIGH-PRESSURE SYSTEM.

An urgent appeal for the relief of unemployment was made at the commencement of the winter of 1921-22; and, in common with nearly every other gas undertaking, we turned our attention to the distribution side. Pressure records were taken in two districts (each some two miles distant from the works, and together serving some 1400 consumers) where for some considerable time complaints of an inadequate supply had been received. After considering the advisability of laying larger low-pressure mains, we decided that the better proposition would be to instal reciprocating compressors at the works, and lay high-pressure feeder mains to the affected areas, with provision *en route* for future extensions.

The compressing plant consists of a No. 1 set Bryan-Donkin horizontal (25 H.P.) steam-driven single reciprocating compressor, capable of passing 25,000 c.ft. per hour, and a No. 2 set Bryan-Donkin horizontal duplex reciprocating compressor, driven by a B.T.H. variable-speed electric motor, capable of passing 50,000 c.ft. per hour. These compressors take a supply of low-pressure gas from a 24-in. trunk main about 30 yards from the station governors. A 10-in. tee was inserted in this main, and a 10-in. main laid under the engine-house floor, with three 10 in. by 6 in. tees to serve as inlets for the compressors. The 6-in. outlets deliver into a receiver 12 ft. long by 4 ft. 6 in. diameter situated 6 yards from the compressors, for the purpose of trapping condensation, and of acting as an anti-pulsator. An 8-in. steel main is taken from the receiver for a distance of 1300 yards, and, after serving a 4-in. branch, is diminished to 5 in. The 5-in. main is carried a distance of 440 yards and is then split into two 4-in. mains. The total length of the three 4-in. mains is just over 3000 yards. All the high-pressure mains are of steel, with welded joints. Two districts are provided with an above-ground governor house, each 10 ft. by 10 ft. by 10 ft. inside dimensions, and each containing "Reynolds" governors in duplicate. The latter reduce from a varying inlet pressure of from 8 to 16 lbs. per sq. in. to a fixed outlet pressure of 38-tenths, at which pressure the gas is delivered into the low-pressure district mains. A third set of "Reynolds" high-pressure outlet governors has been installed at our showrooms, and serve the high-pressure Keith lights working on an outlet pressure of 56 in. water column. In connection with this scheme, we have installed a "Widlake" distance pressure recorder in each governor house, thus enabling us to have a continuous reading of the pressure on the outlet of each district governor in the compressing engine-house. No. 1 compressing set is in use every day (except Sunday) from 7 a.m. till midnight, and gives an outlet pressure of 8 lbs. per sq. in.; while No. 2 set is running every Sunday morning during the peak load, giving an outlet pressure of 16 lbs. per sq. in.

The whole of the excavating for the steel mains, and subsequent filling-in, was done by men engaged by us under the Unemployment Grants Committee Relief Scheme; the work being commenced in December, 1921, and completed, with the exception of the governors, by the following June. The governors were fixed later in the year; and the whole plant was brought into operation in the early part of 1923. In addition to high-pressure mains, a new 24-in. trunk main was laid from the gasholders to the station governors, in place of an existing 16 in. The new main was laid immediately behind the 16-in. one; all the principal connections being made during the night, and without interruption of the supply to the city.

WATER-GAS PLANT.

Having placed ourselves in the position of being able to maintain a good pressure throughout the whole of the area of supply, our output began to increase to such an extent that the question of additional gas-making plant confronted us. Three schemes were considered: (1) Extending the existing horizontal retorts. (2) The installation of vertical retorts. (3) The installation of a carburetted water-gas plant. The first was ruled out on account of running costs, the second necessitated heavy capital expenditure, while the third appeared to be the most economical both for capital and running costs. Tenders were accordingly invited for the supply and erection of a 500,000 c.ft. per diem carburetted water-gas plant complete with waste-heat boiler; and the work was entrusted to Messrs. Humphreys & Glasgow, Ltd. The question of housing this plant was quickly solved by utilizing an old purifier house; but it was necessary to raise the height of this building. The old wooden roof was taken off, and, after the height of the building had been raised 4 ft. 6 in., replaced by a steel-framed roof with corrugated asbestos sheets, in place of slates. The blowers and gas-compressors were housed in an engine-house made by walling-off a portion of this building, and covering with a flat reinforced concrete roof which serves as a coke storage for the water-gas plant. This roof has been placed at a height which brings it level with the operating floor. The coke is raised to the operating floor or storage by a hydraulic lift worked by the boiler feed pump.

The water-gas plant consists of the usual generator, carburettor, superheater, &c.; the waste-heat boiler being fixed so as to permit of the blast gases passing through it. Duplicate blowers have been provided, steam and electrically driven respectively. The electric blower is used when starting up from cold. When, after three-quarters of an hour to an hour's working, 80 lbs. of steam have been raised in the boiler, the electric set is shut off, and the turbine blower brought into operation. A 16-in. main conveys the water gas to No. 1 holder, which has a capacity of 300,000 c.ft. From the holder, the gas passes through a rotary meter, and joins the coal gas at the exhauster inlet; the mixed gas passing through the washers and purifiers to Nos. 2 and 3 holders.

Discussion.

The PRESIDENT said that the paper, which was of great interest, constituted a record of difficulties successfully overcome. Mr. Roberts was to be congratulated upon the way in which he tackled the troubles which faced him in 1917; he seemed to have been fortunate in getting the work done economically. The use of the long-distance pressure recorders was an innovation, and he would like to know the author's experience of them. He supposed there was no great difficulty in arranging with the Post Office for the hire of the necessary line. It was an excellent idea, and would appeal particularly to those whose area of supply covered a large district.

Mr. H. DAVIES (Chesterfield) observed that the contribution contained many interesting suggestions. He himself had put in a water-gas plant, and it was a valuable adjunct; but, to be an economic proposition, the prices of coke and other residuals must be reasonably low. Did Mr. Roberts find it was advantageous to manufacture water gas to-day? He felt it was a mistake to develop water-gas plants unless one was compelled to make provision for increased output.

Mr. G. HELPS (Nuneaton) inquired the quality of gas.

Mr. F. SHEWRING (Stratford-on-Avon) considered that the problems which confronted Mr. Roberts had been ably overcome. The absence of figures did not enable them to discuss the paper at any length. He thought the question of supplementary pressure on the district should be carefully watched from the point of view of installation cost and, later, running expenses of the machinery. Generally speaking, he thought it was advisable to adopt the bigger initial expense and put in a large enough main, and so dispense with the continual upkeep of electrical or steam-driven plant.

Mr. W. S. MORLAND'S experience with the mains at Gloucester had been somewhat similar to the author's. He had debated whether they should put in a boosting plant or lay larger mains, and he decided upon the latter—a job that would last 50 years. He had installed at extensive points of delivery—7 miles from the works—eight recorders in consumers' houses. He paid a small sum for the privilege, and the householders posted the records daily. If the outer districts were well supplied, it might be fairly assumed that the intermediate places were getting a satisfactory service. As to water gas, there were other considerations besides the working of the plant itself; if some of them had not introduced a water-gas plant they would have been "snowed-under" with coke. With it, however, they were able to regulate the amount of coke, and the coke market.

Mr. ROBERTS, in reply, stated that the recorders had been in operation since March last, and there had been no trouble with their working. They paid the Post Office £22 to run the wires from the works to the several points. Having regard to circumstances at Hereford, he thought the water-gas plant would be the most economical of any. The question of regulating the coke market could not be omitted from consideration. The quality of the gas was 460 B.Th.U. Regarding the waste-heat boilers, for 8 out of 17 hours they obtained steam without cost, and there was a surplus.

Gas-Pipe Wrapping Machine.

In the Nov. 10 issue of the "American Gas Journal" there appeared an illustrated reference to a portable wrapping machine for gas-pipes used for the first time by the Pacific Gas and Electric Company during the construction a few months ago of a 6-in. gas-main in Marin County, just across the bay from San Francisco. It is explained by Mr. Charles W. Geiger that the machine was used for wrapping all the pipe laid in the flat part of the route, which was the portion in need of the most protection, as this part of the line lay very near water. The pipe that is to be wrapped is fed into the centre of a wheel, which, on revolving, drives milled wheels that grasp the pipe and rotate. At the same time they push the pipe forward, so that the felt covering, which has been previously impregnated with asphalt, is wrapped spirally round the pipe. Before the felt covering reaches the pipe, however, it goes through a vat of asphalt, heated to approximately 375° Fahr., so that it is coated on both sides with the hot material, which it carries to the pipe. The machine does the work at such a rate that the operation is completed well before the asphalt has set; and the result is a thorough bond without voids. The cost of the protective coating applied to the pipe in this way is found to be surprisingly low—particularly to anyone who has had experience of applying such a material by hand. On the occasion referred to, 33,458 ft. of this 6-in. main were wrapped and hauled to the ditch side without damage to the covering.

THE "C.P." DIAPHRAGM.

Readers will be interested in some particulars of the patent "C.P." diaphragm by which the inventors and makers, Messrs. Joymanco (Brighton), Ltd., of Hove, Sussex, claim to overcome the troubles which now beset the industry, owing to altered conditions in gas values and pressure. Consumers' meters are now subjected to an excessive strain, which they were never designed

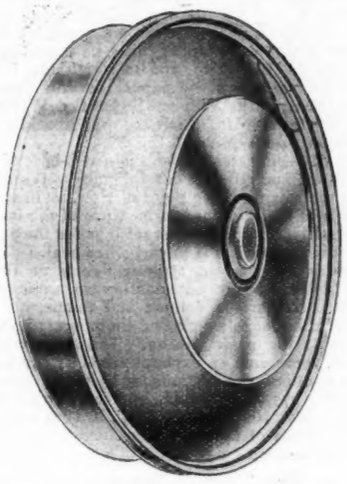


Fig. 1.—Complete Diaphragm, inflated.

to bear; and there is ample evidence that the diaphragm leathers soon succumb to naphthalene, and the effects of vaporizing. Repairs are costly and frequent, and the life of the meter is shortened.

Meter manufacturers are well-aware of these troubles, and are endeavouring in various ways to overcome them. The rim or bag type of diaphragm has been discarded by some makers, and the disc or pan pattern adopted.

There is a variety of designs in use; but all have their weak points, and fail to give satisfaction. In some instances the leathers are secured on the outside of the diaphragm rim by a steel band. This may give a gas-tight attachment when first fitted; but the leathers eventually contract, and leakage occurs. Others have the leathers fitted to a narrow tinplate rim, which in turn is soldered to the diaphragm rim. This operation may cause injury to the leathers; the heat from the soldering irons scorching the leather, which soon perishes.

In the patent "C.P." diaphragm, the makers have departed from the usual practice by attaching the leathers to the inside of the rim, which is tapered and provided with an annular groove or recess at a suitable distance from the outer edge. Fixing is by means of a split ring inserted into the annular recess, and the respective ends of the split ring are juxtaposed by a tool of ingenious and registered design, engaging at each end of the ring whereby the leather is held between the rim and the split ring, giving a perfectly gas-tight joint without the puckering of the material. The entire operation occupies but a few seconds. The leather is neatly stitched to a wire ring, which, with the surplus material, rests upon the edge of the tapered rim. The object of having the rim tapered is to allow easy access and fixing of the split ring to form the gas-tight joint; moreover, it means more complete employment of the gas chamber. The leather disc is easily detached by inserting the handle end of the special tool provided, and gently levering out the split ring.

Another feature is the small annular groove (one male, one female) in each metal disc. The leather is compressed between them, which makes a perfect seal and prevents leakage.

We are informed by the makers that the "C.P." diaphragm is incorporated in all dry-meter repairs executed by them up to 20-light size, and is guaranteed indefinitely, subject to fair usage. Many thousands are already in use, and it is claimed that in no single instance has a diaphragm been found unsatisfactory. The diaphragm is suitable for all known makes of dry meters, which fact should commend it to undertakings doing their own repairs. A point is made of treating all leathers with the "C.P." dressing, which is not a plain oil, and contains no graphite. It is the firm's own preparation, used with complete success for many years. They point out that it entirely resists naphthalene, keeping the leathers moist and pliable.

Fig. 2.—Metal Rim with Recess A.

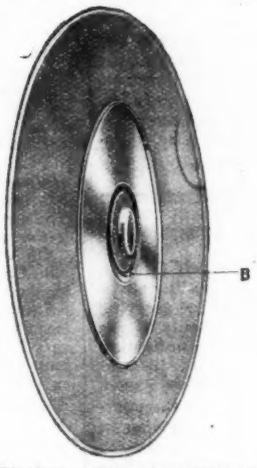


Fig. 3.—Diaphragm Disc—showing Metal Discs attached, and Recess B.

Fig. 4.—Split Ring.

Steel Cutting by Town Gas.

It is pointed out by Mr. J. H. Gumz in the "American Gas Journal" (Nov. 10) that, when steel cutting is alluded to in the newspaper Press, great stress is always laid on the intense heat generated by the oxy-acetylene or oxy-hydrogen flame; the inference being that this high temperature is necessary for the work. As a matter of fact, nothing is, says Mr. Gumz, farther from the truth. In no case is it requisite to heat the steel above 1300° or 1400° Fahr.—a cherry red. Red-hot iron will burn in the presence of oxygen, just like wood or coal. A piece of steel can be heated over a blacksmith's forge, and a jet of oxygen will quickly cut or burn it in two, without acetylene or other heating. What is necessary is to heat the metal to the point at which it will burn in oxygen, and this can be accomplished by town gas as well as by any other means. As the cutting or burning progresses, more and more heat is generated. A curious fact, of which no satisfactory explanation has yet been found, came to light during the cutting of the three-plate laminated protective decking of certain scrapped battleships. In places the red lead filler between the plates was ¼ in. thick, and this was seemingly too much for the oxy-acetylene torch to cut through. The same trouble was not experienced with town gas. For the purpose of comparing the costs of the two methods, tests were made by the same operators cutting continuously for fifteen minutes in each case; the character of the material cut being the same for both gases. The resultant figures show a net saving in the case of town gas of $1.93 for each 100 in. of 6-in. plate cut, and of $0.82 for each 100 in. of 1 1/16-in. plate cut. Prices taken were: Town gas, $0.75 per 1000 c.ft.; oxygen, $1.05 per 100 c.ft.; acetylene, $2.75 per 100 c.ft. The figures quoted relate to the use of gas for cutting old material covered with rust; but, according to the writer, the same results can be obtained in cutting new clean steel. Tests on new steel, applying to work under average conditions, indicate that town gas is approximately 20 p.ct. cheaper for the purpose. This result is arrived at taking town gas at $1 per 1000 c.ft.; hydrogen, $0.90 per 100 c.ft.; acetylene, $2.75 per 100 c.ft.; and oxygen $1.40 per 100 c.ft.

Fire which recently destroyed the exhauster-house of the city, at a loss of $50,000, threatened to deprive Grand Rapids of its gas supply. About 2 million c.ft. of gas was contained in the high-pressure tanks, which for a time were threatened by the fire. The fire originated with an explosion, presumably caused by the combination of a gas escape and a short circuit in the electric equipment.

ETHYLENE ABSORPTION WITH CHLORSULPHONIC ACID.

In an article in "Brennstoffchemie" (abstracted in "Das Gas- und Wasserfach"), Traube and Justh describe the possible use of chlorsulphonic acid for the absorption of ethylene in gas analysis or in practice. They claim for it an efficiency in every way equal to that of the more generally used fuming sulphuric acid. Its reaction with ethylene is almost instantaneous and complete, even with gas mixtures containing but little ethylene. It is best, they say, to use the chlorsulphonic acid not alone (which is apt to give slightly low values) but in mixture with its own quantity of concentrated sulphuric acid. Absorption tests were carried out according to Hempel's method in pipettes which contained the absorbent; the gas being forced into them out of Hempel burettes, using mercury as the containing liquid. The absorption was instantaneous; but, before taking the readings, it was necessary to remove, by means of an alkaline solution, the acid vapours present in the gas.

A comparison is given of results obtained with sulphuric acid, with chlorsulphonic acid alone, and with the two in mixture, from gas mixtures of ethylene and hydrogen, and ethylene and nitrogen. These results wholly confirm the claims of the authors, that chlorsulphonic acid answers all requirements as an absorbent of ethylene for gas analysis purposes. In dealing with gas mixtures, it is, of course, necessary first to remove any other matter which reacts with chlorsulphonic acid. This especially concerns the homologues of ethylene.

The product of the reaction of chlorsulphonic acid and ethylene represents a combination for which there are many possibilities in actual practice. Under treatment with water, for instance, there results an 84 p.ct. product of alcohol, hydrochloric acid, and sulphuric acid; the remaining 16 p.ct. of the ester forming with water ethyl chloride and sulphuric acid. By treating the ester with hydrochloric acid, instead of water, the result is almost entirely the very valuable product ethyl chloride, so that the technical following-up of the absorption of ethylene with chlorsulphonic acid promises good results. The speed of the reaction satisfies all requirements for practical application, and even exceeds that obtained by the use of sulphuric acid, as is shown by tabulated results of actual tests.

The percentage production of the chlorsulphonic acid ethylene ester up to saturation point varied between 89·3 and 81·8 p.ct. of the ethylene passed through; the efficiency, in the course of the reaction, naturally diminishing with increasing saturation of the absorbent. In practice, active carbon might well be used to absorb those portions which, even at 0° C., volatilize in considerable quantities, owing to the high vapour tension of the ester.

The results described above are said to be confirmed by analogous experiments carried out in the dyestuffs industry.

Gas Used for Silver Products.

The Rogers, Lunt, and Bowlen Company, of Greenfield (Mass.), an old-established firm manufacturing high-grade sterling silver goods, have naturally had experience of various fuels for carrying on their operations; but as soon as an adequate supply of gas was assured, they began to use this, with surface combustion burners, for the die hardening and annealing furnaces. In a reference to the matter, the "Gas Age-Record" for Nov. 3 says competition in the sterling silver field is very keen. As the composition is fixed by law, it is not possible to make any savings in the material; and it is therefore in the manufacturing processes that economies must be effected, if at all. In this business, it is efficiency that counts. There is nothing so small that it can be overlooked, if it is calculated to cut down the cost of production. Gas is used in the plant referred to because it does this very thing. The die hardening can be accomplished with greater precision by the aid of gas than with any other fuel tried. With the dies all properly hardened, the presses in which they are used can be made to turn out more work, and more perfect work, in a day. An improperly hardened die means not only lower production, but more work on the stampings and also a greater loss of material. Gas therefore ensures a reduction in the cost of production, by rendering it possible to harden the dies quickly and accurately to just the right degree of hardness, because of the perfect control of the temperature that its use makes possible. Before the parts to be made into the finished ware can be stamped out of the plates, these have to be rolled down to just the right thickness; and since each passage through the rolls results in hardening these plates, it becomes necessary to anneal them to prevent their cracking. A quick, intense heat, under the complete control of the operator, is needed for the best results here, and once again gas proves its superiority. The surface combustion method of burning gas has been highly satisfactory in this plant.

An informal meeting is to be held at the Institution of Civil Engineers next Wednesday evening, at 7 o'clock, when the subject of "The Lighting of Factories" is to be introduced for discussion by Messrs. W. P. F. Fanghaenel, B.Sc., and W. Newton Booth, B.Sc., Assoc.M.Inst.C.E.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Mr. Thorman's Southern Association Paper.

SIR,—May we trespass on your space to correct an inaccuracy which occurs in the report of the very interesting paper presented by Mr. Thorman to the members of the Southern Association last week?

He states that in the installations of our design which he visited, Babcock and Wilcox water tube boilers were working on natural draught. Apart from the boilers of this type operating in conjunction with our settings at Tottenham, and to which Mr. Fisher referred in the subsequent discussion on the paper, the only others, as far as we are aware, are those at the Windsor Street Gas-Works, Birmingham, all of which are fitted with a fan so that absolute control of the draught on the settings is obtained.

The question of raising steam from the waste heat of a retort setting is very far-reaching, and requires careful study. It must not be looked at purely from the steam-raising point of view, as, in a sense, the capacity of a waste-heat boiler plant is a measure of the inefficiency of the retort setting itself. No one designs settings for the purpose of raising steam. Their primary object is to carbonize coal.

Mr. Thorman gives some very striking figures on the result of the test run of his boilers; but on examination we are unable to reconcile them. Calculating from the volume and temperature of the waste gases at the actual boiler inlet, we find there are 16,906,000 B.Th.U. per hour available for steam raising. The actual amount of steam raised, however, represents an expenditure of 17,947,300 B.Th.U. per hour. Adding to this figure the amount of heat leaving the boiler at 225° C., which is 5,277,000 B.Th.U., and the amount of heat radiated from the boiler, which is 291,000 B.Th.U., we get a total of 23,515,300 B.Th.U.—an efficiency of 140 p.ct. Surely one or more of the basic figures requires correction.

THE WOODALL-DUCKHAM VERTICAL RETORT AND OVEN CONSTRUCTION COMPANY (1923), LTD.
ARTHUR DUCKHAM, Chairman.

Grosvenor Gardens, London, S.W. 1, Dec. 3, 1923.

"Sensible Heat" and Coal Carbonization.

SIR,—There has recently been a number of patents taken out for retorts in which the so-called "sensible heat" of gases is used for carbonization of coal or other materials.

I believe that the original idea was due to myself and the late Mr. John West, and was embodied in patent No. 114,937. This was applied for on June 11, 1917, and the complete patent accepted on April 25, 1918. We did not use the words "sensible heat," but applied what is now called "sensible heat" to the ordinary Glover-West retorts, with very useful results. We returned a portion of the stripped gas back through the incandescent coke, thereby partially cooling the coke and at the same time heating the gas so that its sensible heat helped in the carbonization of the upper layers.

In our case we had external, as well as internal, heat. In several cases which have recently been noted in the Press, the sensible heat has been entirely used within the retort, without external heating. The gas used for "sensible heating" is naturally an inert gas—that is to say, any gas which contains no oxygen, such as producer gas.

On Aug. 28, 1917, in conjunction with the Nitrogen Products and Carbide Company, I took out another patent (No. 128 660), in which acetylene was used as the inert gas. This was completed July 3, 1919. I have not found that anyone before these dates had suggested the use of the (sensible heat) inert gas for carbonization, and it seems to me to make very little difference whether a combination of the sensible heat of inert gas is entirely used, or whether it is used in conjunction with external heat.

F. MOLLWO PERKIN.

Albion House, No. 59, New Oxford Street, W.C., Nov. 27, 1923.

Rubber Joints for Gas-Mains.

SIR,—In reply to the question in Mr. Livsey's letter in your last issue, the rubber used in the experiments referred to in my article was obtained from the Standard Insulator Company, Ltd., of No. 41, Rathbone Place, Oxford Street, London, W. 1.

The results of these experiments leave me in no doubt whatever that a suitable rubber composition, properly vulcanized, is obtainable to-day, which would equal in suitability and permanence that which I used over twenty years ago.

WALTER HOLE.

Dentdale, Barton, Torquay, Nov. 30, 1923.

SIR,—In reply to the letter from Mr. Livsey, the rubber which was used by Mr. Hole in his experiments was supplied by us, and is a special mixing made for the Victaulic Company. We can assure your correspondent that it is more than equal to anything that has been made so far in the rubber industry. The average tensile strength is 3500 lbs. to the square inch, and the material is practically immune from damage by gas fluids.

THE STANDARD INSULATOR COMPANY, LTD.,
F. SAVAGE, Manager.

41, *Rathbone Place, Oxford Street, London, W., Dec. 3, 1923.*

Dunstable Gas and Water Company Capital Issue.—Messrs. A. & W. Richards are offering for sale by tender £6500 of 6 p.ct. preference gas capital (irredeemable), in shares of £10 each, in the Dunstable Gas and Water Company, at the minimum price of par. Tenders are to be sent in to No. 37, Walbrook, E.C., not later than 11 o'clock to-morrow (Thursday) morning. Increasing demands for gas render extensions necessary.

REGISTER OF PATENTS.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Nov. 28.]

Nos. 29,099 to 29,702.

CLARK, LTD., G.—"Attachments for tapping, drilling, &c." No. 29,202.
CRUSE, H.—"Generation of gases." No. 29,121.
DAYNES, H. A.—"Gas analysis apparatus." No. 29,597.
DICKER, S. G. S.—"Processes of carbonizing." No. 29,536.
DRAKE, J. W., and DRAKES, LIMITED.—"Mechanism for discharging contents from gas retorts." No. 29,111.
FOWLES, W. E.—"Controller for gas rings, stoves, &c." No. 29,628.
HARRISON, H. T.—"Apparatus for reflecting light or heat." No. 29,424.
HOCKINGS, A.—"Combined gas and coal range with hot water arrangement." No. 29,229.
HUMPHREYS & GLASGOW, LTD.—"Apparatus for manufacture of water gas, &c." No. 29,503.
LEWIN, K. A. H.—"Liquid or gas meters." No. 29,624.
MARKS, E. C. R.—"Erection of dry gasometers." No. 29,514.
MARKS, E. C. R.—"Foundations of gasometers." No 29,515.
MASCHINENFABRIK AUGSBURG-NÜRNBERG AKT.-GES.—See Marks. Nos. 29,514, 29,515.
S.E. COMPANY.—See Dicker. No. 29,536.
STELFOX, J. C.—See Humphreys & Glasgow. No. 29,503.
SMITH, J. W.—See Clark. No. 29,202.
SPENCER, A. L. H., and SPENCER-BONECOURT, LTD.—"Apparatus for heating or superheating fluids." No. 29,700.
SQUIRE, W. W.—"Method of construction and laying of pipes, &c." No. 29,246.
WARD, H. H.—See Fowles. No. 29,628.

APPLICATION FOR EXTENSION OF PATENT.

The CHEMICAL ENGINEERING & WILTON'S PATENT FURNACE COMPANY, LTD., applied for an order that the term of letters patent No. 26,910, of 1907, may be extended.

PARLIAMENTARY INTELLIGENCE.

Notice has so far been published of the intention to promote in the 1924 Session of Parliament the following Bills containing clauses having reference to gas undertakings.

Croydon Corporation.—The Croydon Corporation seek power, among other things, to alter and adjust the boundary between the borough and the urban district of Mitcham, to make corresponding alterations in the parishes of Croydon and Mitcham, and to enact all necessary, convenient, and consequential provisions in relation to the proposed alteration of areas, including corresponding alterations in the areas of supply for gas, water, and electricity of the Croydon Gas Company, the Wandsworth, Wimbledon, and Epsom District Gas Company, the Corporation, the Metropolitan Water Board, and the County of London Electric Supply Company, Ltd.

Manchester Corporation.—In a General Powers Bill to be promoted by them, there is a clause to alter the Corporation's area for the supply of gas by excluding therefrom the township of Timperley in in the rural district of Bucklow in Cheshire, and by including therein the parishes of Carrington and Partington in the same district, and to extend to those parishes all the powers and authorities of the Corporation with respect to the supply of gas or incident or relating thereto.

Rhymney and Aber Gas Company.—The Company intend to promote a Bill for the conversion and consolidation of shares into stock; the issue of consolidated ordinary stock in lieu of ordinary shares; the adoption of the therm basis of charge; the fixing of basic prices and differential charges in various parts of the area, and rates of dividend; the establishment of profit sharing; the confirmation of an agreement between the Company and the Powell Duffryn Steam Coal Company, Ltd., as to the supply of gas by that Company to the Rhymney Company; authorizing contracts for the supply and purchase of gas in bulk; and agreements with other gas companies for mutual assistance and as to working.

Rotherham Corporation.—A Bill to be promoted by the Rotherham Corporation will contain, *inter alia*, further provisions in reference to the gas undertaking.

Co-Partnership at Hornsey.—An extraordinary general meeting of the Hornsey Gas Company was held last Friday, at No. 5, Great Winchester Street, E.C., when, on the proposition of the Chairman (Mr. A. M. Paddon), seconded by Mr. A. F. Phillips, a resolution was passed "that the proprietors of the Hornsey Gas Company hereby approve and authorize the application by their Directors of the principle of co-partnership to the employees of the Company." The proceedings were of a purely formal character.

Public Lighting Protest.—When John Smith was summoned at Keighley for non-payment of 1s. 3d., a portion of his rates, he said he had deducted this amount as a protest against the lack of public lighting, with particular reference to a street lamp which he thought ought to be lighted and had not been used since the war. He had approached the Haworth Lighting Committee unavailingly. For 300 yards there was no light, while in another area there were two lamps in 180 yards. He was ordered to pay the sum and 2s. 6d. costs; and the Chairman of the Bench remarked that his protest had been very cheap. Perhaps the Haworth authority would take notice of it.

MISCELLANEOUS NEWS.

NEWINGTON GAS EXPLOSION.

Official Statement.

On Tuesday, Nov. 27, a violent gas explosion occurred under the roadway in Newington Causeway. Excavation works of the City and South London Railway, the tubes of which run under the roadway, had caused a disturbance of the soil. The tubes are being enlarged by 18 in., and the boring shields had apparently cut into earth which supported loose layers above. The following official statement has been issued on behalf of the Railway Company and the South Metropolitan Gas Company:

"Many of the reports which have gained currency as to the cause of the mishap which occurred on the extension works of the City and South London Railway are of a character likely to cause the public undue anxiety; and we therefore desire to place the true facts before you and beg that the fullest prominence may be given thereto.

"The City and South London Railway was constructed thirty-six years ago, at a time when it was impossible to foresee the enormous development of the present underground system of electric locomotion. It was therefore designed as an independent line, serving an important area lying between Clapham Common and the City. To-day, through communication between the whole of the underground system has become of paramount importance; and for this purpose the existing railway, which, as is well known, is contained within a strong cast-iron tunnel, is being enlarged by an additional eighteen inches, and will then be large enough for the transit of standard coaches.

"The mishap was caused by the excavation works coming in contact with what is probably an old storage well. This caused an inrush of sand and water into the tunnel, leaving a crater-like empty space beneath the surface of the road. Being thus robbed of their support, the various mains and cables for gas, water, and Post Office, &c., collapsed into the opening. The gas main did not explode. It broke by reason of its unsupported weight; and, forming an explosive mixture with the air contained in the space void of soil, the gas became ignited. The hole in the ground was therefore the cause, and not the result, of the explosion, and was in no way affected by the gas burning from the fracture in the main before it could be plugged.

"The accident was in every way an exceptional one; and the Company's engineers, who have had a very wide experience, are anxious, through the columns of the Press, to assure the public that nothing need shake its faith either in the security of tube railways or of gas-mains, both of which now form an essential part of those modern conveniences enjoyed so widely and performing such necessary functions.

MOTT, HAY, AND ANDERSON,
Engineers to the Railway Company.
CHARLES CARPENTER,
President, South Metropolitan Gas Company."

Yesterday, Colonel A. H. L. Mount, of the Ministry of Transport, opened an official inquiry into the circumstances of the subsidence; and a report of this will be published in next week's "JOURNAL."

PRICE OF GAS IN BIRMINGHAM.

Another Reduction Recommended.

The Birmingham Gas Committee, in a report to the City Council, recommend another reduction of 3d. per 1000 c.ft. in the price of gas. They point out that when their last report was submitted in October, it was stated that the Committee had every desire to reduce the price of gas, and that, though it was difficult to forecast very far ahead, it might be possible before many months were past to make a further reduction. The financial position of the department had been carefully reviewed and considered, and the Committee were now able to recommend a further reduction as from the December reading of the meters.

The last reduction was an all-round one of 6d. per 1000 c.ft. from the September reading of the meters, and applied to all consumers, without exception. In the present instance, the Committee proposed to graduate the reductions, which will be 3d. per 1000 c.ft. to consumers for lighting, cooking, and domestic purposes up to 4,000,000 c.ft. per quarter, and 2d. per 1000 c.ft. for quantities in excess of that figure. For manufacturing and motive power, the reduction would range from 3d. per 1000 c.ft. for quantities up to 1,000,000 c.ft., to 2d. for quantities exceeding 1 million, but not exceeding 4 million c.ft., per quarter. For larger consumptions the charge would be 1s 10d. per 1000 c.ft., as at present.

The percentage increase over and above the 1915 prices carried by the reduced rates would, for lighting, cooking, and domestic purposes, range from 41·67 in the case of the small consumer to 51·31 for the large consumer; while for manufacturing and motive power it would range from 47·37 to 51 p.ct. If the Committee's proposals were approved, the increased quantity of gas to be supplied to all prepayment consumers would be 2 c.ft. per penny.

Fatal Gas Leak at Newcastle.—Consequent, it is believed, upon an accident due to a pipe burst through the frost, a Mrs. Blackwood was found dead in bed at Old Walker, Newcastle-on-Tyne. In other rooms a lodger and Mrs. Blackwood's two children were lying unconscious from gas poisoning.

ORIENTAL GAS COMPANY, LTD.

The Ordinary General Meeting of the Company was held last Wednesday, at Finsbury House, Blomfield Street, E.C.—Mr. H. D. ELLIS in the chair.

The SECRETARY (Mr. S. Rainer) read the notice convening the meeting, and the Auditors' certificate. The Directors' report and the statement of accounts for the year ended June 30 were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, remarked that he had been accustomed on similar previous occasions to run through the accounts with the shareholders, and to interject a few observations with regard to the items which might prove of some general interest. Taking first the revenue account, on the credit side—which was the most pleasant side—it would be seen that the gas rental reached £100,964, which was an increase of £10,985 upon that of the preceding year. This was explained by their having carbonized about 4000 tons more coal. In consequence of the good general working, and of the increased amount of coal carbonized, they had been able to sell some 33 million c.ft. more gas than was sent out in the year before. This was a very gratifying feature.

GOOD WORKING RESULTS.

While on the subject of the gas, he would take the opportunity of pointing out that both purity and pressure had been well maintained throughout the year. During this time, the Corporation had not once required a joint test of the purity of the gas, as they might have done under the contract. Further, they had not alleged a single case of insufficient pressure. So the Company had acted fully up to their time-honoured maxim: "Sell the best possible gas at the lowest possible commercial price." He might add one other remark with regard to carbonization—namely, that the make of gas per ton in the year under review had shown results equal with last year's. These were all favourable points; and the proprietors would be glad to realize that the capital per ton of coal—which had been always light—had been reduced by this greater quantity carbonized to the extent of 10s. per ton, bringing the actual figure of capital issued per ton of coal carbonized to rather less than £5 17s. This was, of course, extremely low. Keep the capital down, and one was fairly safe. Residual products had shown up very well indeed; there having been an increased yield from this source of £1374, as compared with 1922, which was a good year in itself. In the matter of coke, he could not report any increased sale; but this was a deliberate policy. They utilized for purposes of carbonization a quantity of their own coke, instead of placing it on the market. Thus they obtained full value for it. Of tar they had secured very good sales at a higher price. Everything in Calcutta had gone up, and the Company had profited from this here and there; tar being an example. The most noteworthy point, however—though it was not the largest, but the smallest, item—was in connection with sulphate of ammonia. Their make of this in the past year had been quadrupled. There was a good demand for it, and they had sold it all at a higher price. In point of fact, sulphate of ammonia yielded £1651, which represented a very large advance. In exchange there was a small receipt, instead of a debit, as on the last occasion.

REVENUE AND CAPITAL.

The total revenue amounted to £150,813, which was the highest yet recorded in the history of the Company, though he hoped it might be exceeded in years to come. This, it would be noted, was a clear 50 p.ct. upon the paid-up capital, which had never varied from £300,000. They had never made a further issue of capital, and he hoped they never would. They would continue to work as they were working now. Issuing capital cost money which did not bring in any return. He could not help thinking that there were not very many gas companies who could show a revenue of 50 p.ct. upon their paid-up capital. Their own Company was a shining example. This disposed of the credit side. On the debit side there was first of all a big item which was unavoidable. Coal had cost nearly £50,000. The price of coal had gone up since the beginning of the year, and it was now extremely dear. They must, however, pay what was asked, if they wanted the coal. Salaries in India and London were practically the same—only £49 more. Directors and Auditors had taken no more. Indian income-tax was, however, up by £1533. There, again, was a matter against which they could not strive or struggle; they had to pay it like other people. Mains, services, meters, and fittings figured at £20,627. This was less by £3786 than in 1922. Wear and tear of works showed an increase of £6023. Bad debts and allowances were very low at £72; and general expenses were only £200 more. Passing to the balance-sheet, expenditure on capital account had been increased by £17,872. This was a portion of the total expenditure on extensions, renewals, and general upkeep, which came to £49,000, of which they had only attributed £17,000 to capital. "Spare your capital, and carry all your debits to revenue as far as you can." This was the maxim the Company adopted. They had, as a matter of fact, charged £16,000 to revenue, and the balance of £15,000 to the renewals suspense account. The amount due to the Company was up £1436; while coals, products, and sundry stores remained at much the same figure as before. In the amount invested there was no alteration. Cash in London and Calcutta was £2300 more. On the debit side, the first three items remained unchanged—capital £300,000, reserve fund £6000, and depreciation account £50,000. They had never had occasion to use this depreciation account, but no doubt it would come in very handy some day. Now he came to the renewals suspense account, which, as he had already pointed out, had been reduced from £27,000 to £12,000. This account was established at a time when they had many important works started or in contemplation; but they could not get on with them, either because of the war or the upset to trade after the war. It was prudent then to put aside a sum out of savings on revenue, so that when the jobs could be taken in hand the money would be available. It was stated in the report that many important operations had been undertaken. He would not touch upon the nature of these works, as he was going to ask his colleague, Mr. Stanley Jones, who was an experienced gas engineer, and who was the head of their Works Committee, under whose care all matters of extensions, renewals, &c., were placed, to second the resolution, when he would be able to give them some interesting information with regard to these works. Exchange equalization account remained at £5009; the amount due by the Company (including outstanding dividends and sundries) was less by £918; and loan from bank was £34,280 more. The balance from profit and loss account was up by £3839. He had just told them that issuing capital was an expensive operation, and it was not always beneficial. They got their money, and then when they might wish to pay it off, except in the case of redeemable debentures, there it remained. They applied to their bankers, who, without the slightest hesitation, said they would be pleased to advance the amount the Company required; and as cash came in, this was paid off by instalments.

THE FITTINGS BUSINESS.

With regard to fittings, he might say that the business done by the Company in this connection was very largely increasing. They had a showroom which was situated in one of the busiest thoroughfares of the city; and they endeavoured to make the window display, and the arrangement of the appliances inside, as attractive as possible. There was no doubt that this showroom had greatly promoted the development of the domestic side of the business. In the past year they had fixed 435 cookers, 308 geysers, 316 boiling rings, and a host of other appliances, while many more were on order. In addition to these, they had connected gas to apparatus imported directly by the consumers—such as gas-engines, tyre-heating rings, linotype and monotype machines, sugar boilers, vulcanizers, enamelling ovens, &c. These factors were the more welcome coming, as they did, in a period of business depression, owing to which many people had had considerably to reduce their expenditure. This was a very favourable point. They were looking forward to considerable changes in Calcutta, in the direction of an extension of the Municipality. He believed the Municipality had secured the necessary legal authority to acquire the districts of Maniktala, Cossipore-Chitpore, Garden Reach, and possibly some other minor areas. He did not think this would quite double the area of the Municipality; but, at any rate, it would be a very large addition. The Company would be called upon to supply an enormous number of lamps, &c. They would have noticed from the report that, while there had been no delay arising from labour unrest, as a year ago—the relations with their men being harmonious—climatic conditions had been exceedingly trying. A period of excessive heat, far exceeding all previous records, and bringing with it much sickness, was one source of delay; and this was followed by an alarming earthquake, which, however, wrought no great damage to the works. This great heat affected several members of the staff, but happily they were not concurrently stricken. Some were able to work, while some were not. But this incident brought out the fine qualities of their staff, who exhibited the utmost good-comradeship in helping each other, and loyalty to the Company in taking up the work of those prostrated. For this they deserved the thanks of the shareholders.

THE NEW WORKS.

Mr. STANLEY H. JONES, who seconded the resolution, said he had been asked by the Chairman to make a few remarks on the repairs and renewals, and other work, carried out in connection with the Company's undertaking during the past year. It had been a very busy year, and, as the accounts showed, they had spent a good deal of money in a wise manner. The Manager reported that all hand-charged retorts—he might say that until quite recently a certain proportion of the retorts in their works had been charged by hand—had now been shut down, and all were being operated by machinery. When one had to face strikes such as in the previous year they had experienced in Calcutta, the great importance of machine stoking was realized. The business had grown so much, and the future held such great prospect of extension, that it was necessary to equip the works in all respects to meet the increased demands that might come upon them; and so they had undertaken a good deal of renewal of, and addition to, the purifying plant. The Chairman had told them of the Company's excellent record in the matter of purity. There had not been a single failure during the year. He did not recollect—certainly since the war—that they had had any penalties imposed upon them at all. This was a very good record. As to gasholders, they had overhauled one holder, which he thought was the oldest holder of the Company—perhaps one of the original ones. The smallest holder, he believed, was taken out to Calcutta about the middle of the last century, after it had been bought from the City of London Gas Company. It would give them some idea of the excellence of English iron to learn that this holder had not given out until nearly seventy years of life as a second-hand holder. This had given out, and had been replaced by a new and larger one. Another holder—the second oldest (there were three altogether)—some years ago developed weakness in the lower lift, and the holder had not been effective, except for half capacity, since. So they had tackled this job, and very shortly the work would be completed, and they would have a bigger holder. The Company would then have storage for nearly two days' output of gas, which was a most important consideration in a country liable to influences disturbing to the equanimity of the working classes. It would also provide for a great increase in the business of the Company. On the district of the Company, Mr. Snelgrove reported that he had taken the opportunity afforded by the Corporation and other Municipalities carrying out road widening and repairs, to re-lay to a very considerable extent the Company's mains in a safer position under the footways, and also to enlarge them. This had all been paid for out of revenue. Generally speaking, from his knowledge of gas matters, he did not know of any company, certainly not overseas, trading in gas, which was in a better position than their own to meet future demands.

Mr. PARKER asked whether, apart from actual extensions to bring in new business, the heavy capital expenditure of the last two or three years was now nearing its end. He assumed it was. He had been analyzing the Company's accounts for some years, and had noticed that the item of wear and tear was a very fluctuating one indeed. Did it represent the actual amount spent during the year on repairs and renewals?

The CHAIRMAN pointed out that it was the difference after charging £17,000 to capital account and £15,000 to renewals suspense account,

Mr. PARKER remarked that he knew of a company—not a gas company—who averaged the sum expended in the previous five years.

The CHAIRMAN: It seems to me rather strange. We do nothing of that sort, but simply charge the expenditure of the year.

Mr. JONES: Our renewal suspense account has been built up for the very purpose of dealing with this matter.

Mr. PARKER: The Company is much bigger than it was, and the one item which has not gone up is Directors' and Auditors' fees. I really think, with the increased size of the Company, the Board are entitled to a little more.

The CHAIRMAN: It is a point which had occurred to us on this side of the table.

Mr. PARKER: I notice the item of bad debts and allowances, which used to be very substantial, has now almost disappeared. Is this since you abolished allowances?

The CHAIRMAN: We have, I believe, a very good lot of collectors.

The SECRETARY: The work has been better organized since the appointment of a European Accountant a few years ago.

Mr. J. H. MACKAY remarked that this Company was the most conservative one he had ever been associated with. He believed he was the oldest shareholder, and during the whole of the time he had been a proprietor the capital account had remained stationary, and all the extra profits made had been applied not only to maintenance, but to extension of the plant. While everything else was going up, the dividend did not alter; and he hoped the Board would bear this in mind. He also trusted the Directors would on every possible occasion protest against the corporation profits tax, which was really another income-tax.

The report and accounts were then unanimously adopted.

THE DIVIDEND.

Proposed by Mr. BASIL M. GILL, seconded by Mr. BERTRAM W. ELLIS, it was resolved: "That a dividend of 8 p.ct., less income-tax, be declared for the twelve months ended June 30, 1923, and that the same be paid to the proprietors on Nov. 29, less 3½ p.ct. paid on account on May 31 last."

RE-ELECTIONS.

The CHAIRMAN said it gave him the greatest pleasure to propose the re-election of Mr. Stanley H. Jones as a Director of the Company. The Board attached the greatest importance to Mr. Jones's services. He was a first-class engineer, and possessed all the other qualifications of a Director He was a true colleague.

Mr. H. H. MACLEOD, seconding, remarked that they all knew Mr. Jones's high repute in the gas profession, and what a valuable asset he was to the Company.

The resolution was unanimously agreed to, and acknowledged by Mr. JONES.

The Auditors (Messrs. S. W. Savage and F. J. Bradfield) were re-appointed, on the motion of Mr. WATSON, seconded by Mr. MACKAY.

VOTES OF THANKS.

Mr. BERTRAM ELLIS, proposing a very hearty vote of thanks to the staff, both in Calcutta and in London, said that, as the Chairman had already told them, during the past year Calcutta had suffered very much from unusual heat, which had been felt severely by their staff. In addition to this, there had been a great deal of fever, which had attacked many of those in their service; but they had come through the ordeal well. One particular point was that, in the absence through illness or leave of any members of the staff, others had demonstrated their adaptability and loyalty to the Company by taking on the work. Mr. Smith (the Works Superintendent) and Mr. Garsed (the Accountant) had been on leave. Mr. Smith had renewed his agreement with the Company. Mr. Garsed's was still current, and they confidently expected he would renew when the time arrived. During their absence, Mr. Snelgrove (their Manager) superintended Mr. Garsed's department, and Mr. Savage (the Chemist) took over an entirely new job as Works Superintendent. Previously he had displayed a great deal of tact and ability in dealing with native labour. As to the general working, they had seen that bad debts had come down to almost nothing; while the unaccounted-for gas had also been reduced—and this, in a land of floods and earthquakes, was much to the credit of all concerned. There had been several new buildings lately erected in the city. These were watched by the Company's people, not only while being built, but while being planned; and in every case, he thought, they had been successful in getting gas installed and in seeing that pipes of adequate dimensions were provided. As far as the London staff were concerned, they had to thank Mr. Rainer and his assistants for their excellent work in connection with the large expenditure on new plant during the year. They had had many matters to watch, and had done their duty most thoroughly.

Mr. MACLEOD, in seconding, said the staff deserved great credit for the admirable work they had done.

Mr. RAINER, in acknowledging the vote (which was cordially passed), said it would afford him great pleasure to communicate the satisfaction of the shareholders to the staff in India.

The Chairman and Directors were also heartily thanked for their services to the Company.

Cheaper Gas at Blackpool.—The Blackpool General Purposes Committee have confirmed the reduction of 5d. per 1000 c.ft. in the price of gas as from Jan. 1 next. This will make the charge to the ordinary consumer 2s. 8½d. per 1000 c.ft., as against 3s. 1½d. at present, and 3s. 6½d. last year.

Gas-Works Robbery.—An amazing incident took place on the premises of the Cork Gas Consumers' Company, when, an armed man entered the office, covered the clerk in charge with a revolver, and carried off £100 in cash and notes. The clerk was, of course, taken completely by surprise, and had no alternative but to submit to the hold-up. Immediately after the robbery, the affair was reported to the police (Civic Power), who are actively investigating this and similar occurrences on a smaller scale.

CONTINENTAL UNION GAS COMPANY, LTD.

Annual Report.

At the meeting next Tuesday, the Directors will submit the audited statement of accounts for the financial year to June 30 last, together with the following report.

The Company's interests being mainly Continental are affected, in a special manner, by the economic situation in Europe. The long delays in its healthy re-adjustment, arising from many causes, and greatly aggravated by Germany's monetary policy, have disappointed all hopes of a speedy recovery. The French Exchange, which chiefly concerns the Company, suffered severely, and has caused the Directors grave anxiety. At the close of the financial year, on June 30, 1923, there was a depreciation of no less than 43 p.ct. as compared with the current rate on June 30, 1922. During the current year there have been further serious fluctuations; the rate in August reaching the record figure of 83.60 fcs. to the pound. Since then some improvement has been shown.

The Directors are pleased to report that, to a large extent, their hopeful anticipations concerning the gas industry in France have been justified. The general improvement has enabled the Compagnie L'Union des Gaz to resume the payment of dividends, and 3 p.ct. was distributed on March 1 last. Owing to the unsettled economic situation, no reliable valuation can yet be made of the Company's large Continental holdings.

After deducting management expenses and pensions charges, and making provision for income-tax and corporation profits tax, there remained a credit balance of £14,835. The Directors have transferred £3000 of this amount to the reserve exchange account, as a precautionary measure, leaving £11,835 to be dealt with. Out of this balance, the Directors recommended the payment of a dividend of 7 p.ct., less income-tax, on the preference stock—an increase of 3 p.ct. over the dividend paid a year ago. This is the full amount to which the preference stock is entitled, in any one year, before a distribution can be made on the ordinary stock. The payment will absorb £10,587, leaving a balance of £1248 to be carried forward.

The Directors who retire by rotation are Mr. A. F. Phillips, M.Inst.C.E., and Sir James Remnant, Bart., M.P., who offer themselves for re-election. The retiring Auditors, Mr. C. P. Crookenden, F.C.A., and Mr. G. A. Cave-Orme, offer themselves for re-appointment.

TRADE NOTES.

Spiral-Guided Holder for Harpenden.

Messrs. Firth Blakeley, Sons, & Co., Ltd., of Church Fenton, have secured the order for a spiral-guided gasholder of 500,000 c.ft. capacity, with steel tank, for the Harpenden District Gas Company.

Glover-West Verticals for Leek.

At a meeting of the Leek Urban Council last week, the question of installing vertical retorts was discussed. The Lighting Committee recommended that the tender of West's Gas Improvement Company, Ltd., of Manchester, for the supply, erection, and putting into operation of twelve Glover-West vertical retorts be accepted; and after a little discussion, it was decided to adopt the recommendation.

An Ingenious Memo. Tablet.

An ingenious memo. tablet has been forwarded to us by Metropolitan Gas-Meters, Ltd., of Nottingham. It is called the "Printator" pad. The pad slides in an outer case. Notes are made on the surface of the pad; and when they are no longer required, the slow withdrawal of the latter from the case causes them to disappear, and a clear surface is then presented for further use. The serviceable life of this interesting device must be tested by time and extent of use.

"Stantonite."

From the Stanton Ironworks Company, Ltd., we have received particulars of "Stantonite"—a new impenetrable and non-absorbent preparation for flooring and waterproofing. It is claimed that this material seals the minute interstices of concrete floors, bonds the surrounding structure, and gives a dense compact homogeneous surface which will not "dust-up." The finished floor is waterproof and oil-proof, besides presenting a hard-wearing surface.

About Prepayment Meters.

From Messrs. Sawer and Purves (proprietors, Meters Limited), of Manchester, London, and Nottingham, comes an attractive little booklet entitled the "Victory." It contains much interesting information regarding prepayment meters. This begins with the time when the firm commenced making the first meters of this description under Thorp and Marsh's patents in 1889, and then goes on to 1891, when they designed the first prepayment positive type meter. This was followed by the second positive meter four years later, and ultimately by the third. Then the war and its consequences caused many changes in the price of gas; and to meet the demand for a meter that could be altered easily and quickly without the aid of wheels, the firm state, they designed and patented the "Victory," the prepayment mechanism of which is outside the meter, and is readily accessible. Other points claimed for it are that it is the acme of simplicity, is well and strongly made, and consists of few parts (which, being die-cast, are easily interchangeable). The prepayment valve box is also outside the meter; and should it be necessary to change the valve button at any time, this can be done in two or three minutes.

American Coal for the Bordeaux Gas-Works.—It is reported by the "Iron and Coal Trades Review" that the Bordeaux Gas-Works have ordered from American shippers best coking coals at between 2s. and 3s. per ton less, c.i.f., than the British.

THE NORTH-EAST COAST COAL TRADE.

From our Own Correspondent.

During the past week the recent market strength has been maintained in all sections. The pressure for supplies has continued heavy all round, and with the bulk of available production booked up to the end of the year, prices appear assured, with a tendency to harden. No great inconvenience has been occasioned by the fog, there having been a sufficient supply of tonnage available in most cases to satisfy colliery requirements. In any case, the demand has been sufficient to absorb at good prices any odd lots that have been thrown on the market.

Coking coal has again been in chief demand, and 25s. 6d. f.o.b. has been paid for best sorts, and 26s. asked. This has, as usual, helped the whole of the Durham unscreened market, as so many of the collieries can make coking, steam, or gas coals. But even the purely gas-coal collieries report a better feeling, due mainly to good stemming of tonnage by contractors. Wear Specials and best qualities are still round about 24s. f.o.b., but they are, if anything, rather firmer at this price. Others are 22s. 6d. to 23s.

It is interesting to note that there has been a transaction in best gas for delivery over next year at 24s. Forward business in this market has been hanging fire to such an extent that it has been difficult to give any indications as to a figure at which collieries would close, though they have been quoting 24s. for some time.

YORKSHIRE AND LANCASHIRE COAL TRADE.

From a Local Correspondent.

The house coal trade in Yorkshire and Lancashire has improved, and prices are inclined to an upward tendency. London retailers have advanced their prices 2s. per ton, and Yorkshire and Lancashire will each probably follow to the extent of 1s.

Gas coal quotations are to be advanced at one stroke by 2s. per ton in respect of forward business. There seems to be a decided improvement in regard to the demand from Germany, who are paying for coals in sterling on London. France and Belgium are not buying to the extent of previous months. It appears, therefore, to be purely a question of the settlement of the rates of exchange before business can be carried on satisfactorily.

COAL TRADE IN THE MIDLANDS.

From our Local Correspondent.

Values are well maintained. As regards best qualities of domestic fuel, prices have been advanced 1s. this month. It would be a mistake to draw any wide inferences from this as to the general market position. Though there is local stringency, it is not attributable to any deficiency of output, but to obstacles in the distributive channels. The weather has hampered transport at the same time as it has given an impetus to the domestic demand. In the Birmingham area particularly merchants have had great difficulty in keeping abreast of their engagements owing to wharves being occupied by general merchandise. They have been glad to effect exchanges of odd lots of household fuel to tide them over temporary shortages. Some expansion of demand for industrial coal is noticed. Nuts and beans are moving off well; but supply generally balances demand.

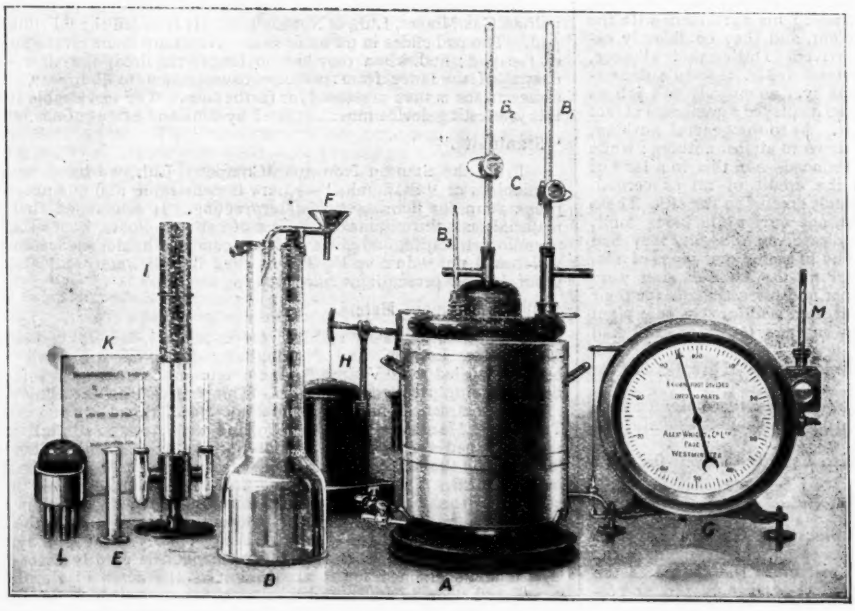
Slacks have not been going so far afield just lately; the export demand having moderated. There is a steady flow of business in the industrial centres. The fixing of prices for blast-furnace coke up till the end of March for the Midland pig iron trade is generally welcomed by smelters. They have not obtained the further reduction for which they have been agitating—24s. at ovens being the price; but even so they prefer stability to a fluctuating or uncertain market. If demand has not increased very much, the stronger tone of the iron trade suggests early developments.

Redhill Co-Partnership Scheme.

The tenth annual report and statement of accounts of the Redhill Gas Company's Co-Partnership Committee were submitted to an enthusiastic meeting of co-partners (which was followed by a successful entertainment) last Thursday. Mr. G. R. Hunt, J.P. (the Chairman of the Committee of Management), presided, and was supported by Mr. W. H. Bennett (Vice-Chairman of the Committee and Managing-Director of the Company), other members of the Board, and the Hon. Secretary to the Committee (Mr. Horace Long). The Chairman pointed out that the dividend paid for the half-year to June 30 last was at the rate of 5¼ p.ct. Consequently, if everyone consented to put his shoulder to the wheel for the remainder of the year, and other conditions were favourable, he thought they might look forward to a dividend at the same rate for the second half-year. In this case, the next annual bonus to be credited to the co-partners would be at the rate of 5½ p.ct., instead of 5 p.ct. Mr. Bennett said the co-partners had saved about £5000, which represented an average holding of about £45. Many of the employees would probably not have had this sum to-day, had it not been for the co-partnership scheme. During an interval in the concert, Mr. W. Lees Stenning, J.P. (the Chairman of the Company), presented certificates in Gas Supply, Gas Fitting, &c., gained by the employees of the Company at the Redhill Technical Institute.

Owing to a short circuit at the West Ham electricity generating station last Monday afternoon, the current was cut-off in some districts of the borough for about a quarter of an hour. Three men employed at the station were badly burned, and were taken to Queen Mary's Hospital at Stratford.

BOYS CALORIMETER



GAS REGULATION ACT, 1920.

CALORIMETER

as prescribed

by

GAS REFEREES.

ALEXANDER WRIGHT & Co., Ltd.,

1, WESTMINSTER PALACE GARDENS,

WESTMINSTER, S.W. 1.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Dec.* 4.

There is little new to report in the London tar products market, except that pitch for the present is lifeless. The statistical position of that product is strong, and it is confidently expected that the price will rise again soon. Creosote continues to improve slightly, and it is quoted at 10d. net in bulk *ex* makers' works. Other articles are unchanged.

Tar Products in the Provinces.

Dec. 3.

With the exception of creosote, markets for tar products have been quiet during the past week. Creosote oil has improved in value, due to the certain demand from the States, from which country a higher price can be obtained, owing to the fall in the exchange. Pitch is very dull indeed, and sales have been reported at figures as low as 110s. on the East Coast. Little or no business has been done, and the price has fallen almost entirely from absence of demand. It is believed that a considerable quantity has still to be purchased for January-April requirements. Stocks are known to be very small indeed; and it is generally believed that an improvement in the price will take place. Carbolic acid is quiet. The demand for crystals is still dull, and the competition of Continental synthetic severe. Naphthalene is quiet, and business is difficult to negotiate, principally by reason of the fact that buyers appear to be unwilling to agree to an advance in naphthalene corresponding to that in creosote oil. Water white products are still very dull, and business is difficult to arrange.

The average values for gas-works products during last week were: Gas-works coal tar, 67s. 6d. to 72s. 6d. Pitch, East Coast, 110s. to 115s. f.o.b. West Coast—Manchester, 105s. to 110s.; Liverpool, 106s. to 111s.; Clyde, 107s. to 112s. Benzole 90 p.ct., North, 1s. 0½d. to 1s. 1d.; crude 65 p.ct. at 120° C., 9½d. to 10d. naked at makers' works; 50-90 p.ct., naked, North, 1s. 5d. to 1s. 7d. Toluole, naked, North, 1s. 5d. to 1s. 7d., nominal. Coal tar crude naphtha in bulk, North, 7½d. to 8d. Solvent naphtha, naked, North, 1s. 2½d. to 1s. 4d. Heavy naphtha, North, 1s. 5½d. to 1s. 7½d. Creosote, in bulk, North, liquid, 8½d. to 8¾d.; salty, 8½d. to 8¾d.; Scotland, 7½d. to 8d. Heavy oils, in bulk, North, 8½d. to 9d. Carbolic acid, 60 p.ct., 3s. to 3s. 2d. prompt. Naphthalene, £15 to £16; salts, £6 to £8, bags included. Anthracene, "A" quality, 4d. per minimum 40 p.ct., purely nominal; "B" unsaleable.

In their report for November, Messrs. Sir S. W. Royse and Co., Ltd, of Manchester, say: Little change can be reported in tar products, consumers generally still showing reluctance to commit themselves to forward business. Benzoles and toluoles have shown no improvement; the further expected drop in the price of petrol has not materialized, and prices remain unaltered. Solvent naphtha has continued in poor demand, and lower values have been accepted. The steady call for creosote remains, and prices are firm. Crude carbolic acid has an easier tendency, but little is offering, and values are unchanged. In naphthalenes the inquiry for the refined quality has fallen away, with consequent lower values, but crude remains fairly steady. In pitch the poor inquiry has resulted in lower prices, but consumers do not seem attracted by the reductions offered. Continental users appear well covered for the time being, and content to await developments. In South Wales business is reported having been done considerably below the present quoted price. The home market for sulphate of ammonia is showing little activity, but export trade has been rather good.

Brentford Gas Order.

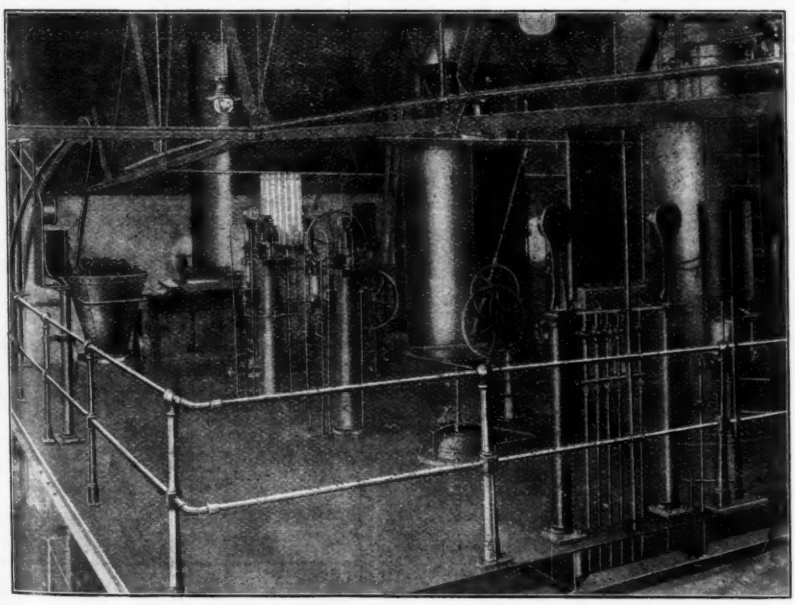
At a recent meeting of the Heston and Isleworth Urban District Council, it was reported that at the inquiry held on behalf of the Board of Trade, with reference to the application of the Brentford Gas Company for a Special Order, empowering the Company to purchase the Richmond and Harrow Gas Undertakings, a settlement has been arrived at on the following terms:

> "The Order to proceed, but with a differential price in the Richmond area of 1·20d. per therm for the first year, 0·80d. per therm for the second year, and 0·40d. per therm for the third year, and subject to the withdrawal of Clause 48, by which the Company sought power to subscribe towards the capital of and take shares in, or lend money to, subscribe for, and hold debenture stock or mortgages of, any company supplying gas in any district contiguous or near to their own limits of supply."

The Director of Gas Administration, who held the inquiry, decided that the question of altering the standard price of gas, which was fixed at 17·8d. per therm, by the Brentford Gas (Charges) Order, 1921, could not be dealt with at that inquiry.

Price of Gas at Cowdenbeath.—The Cowdenbeath Gas Company have reduced the price of gas by 10d. per 1000 c.ft. to all consumers, as from the October survey of the meters. This follows a reduction of 5d. made six months ago.

Chapel-en-le-Frith Gas Supply.—In their annual report, the Directors of the Chapel-en-le-Frith, Whaley, and District Gas Company state that, for the year ended September last, there was a profit on revenue of £4320. To this has to be added the unappropriated balance of the previous year (£6668). The disposable balance is £10,083, and the Directors recommend the payment of a final dividend at the rate of £3 19s. per share, making £6 9s. for the year, less tax. The carry forward will be £3122.



Dempster's Blue and Carburetted Water-Gas Plants for **EFFICIENT WORKING.**

GREATEST ECONOMY IN OIL AND COKE

WE MANUFACTURE AND ERECT THE PLANT.

R. & J. DEMPSTER, LTD., MANCHESTER.

LONDON OFFICE: 34, VICTORIA STREET, WESTMINSTER, S.W. 1.

STOCK MARKET REPORT.

THE steadiness of the exchanges gave more confidence in the House, and during the whole week markets maintained a singularly firm front. British Government stocks showed few changes on balance. War Loan was a shade harder. The market for Foreign Government securities was one of the firmest. Mexicans, Brazilians, Argentines, and Chilians were much in demand, in most instances improving in price. In the Industrial Market there were inquiries for certain classes of shares which were considered likely to benefit from Protection in the event of the present Government being returned to power; but perhaps a more genuine recovery was brought about by the trade revival which has gradually been making itself felt, and which is confirmed by the Bankers' reports. There is an increased activity in the cotton trade; and the production of iron and steel is on a larger scale. The coal industry continues to do well; and shipbuilding is being helped by the settlement of the boilermakers' strike.

Very little information was obtainable about the Gas Market. The transactions recorded were less than usual, and there were few changes in quotations. Portsea Island "B" rose 5, to 105-110, and "C" 3 points, to 100-105; Primitiva 4 p.ct. debenture advanced 1, to 71-75, and South Metropolitan 6½ p.ct. debenture 1, to 106-108. Continental Union 7 p.ct. preference were marked down 3 points, to 90-95; Montevideo fell 1, to 48-53 *ex* div., and Oriental 2 points, to 95-100 *ex* div.

The following transactions were recorded during the week: On Monday, Alliance and Dublin 67, British 122¼, 123, Continental Union 32⅞, European 7⅞, Gas Light and Coke 94, 94⅜, 94⅝, 4 p.ct. preference 78, 79, Imperial Continental 146, South Metropolitan 97, 97½, South Suburban 5 p.ct. 101¾. Supplementary prices, Kingston-on-Thames 107½, 108. On Tuesday, Brentford "A" 103½, 103⅝, "B" 103¼, Gas Light and Coke 94, 4 p.ct. preference 78, South Metropolitan 97¼, Southampton 4 p.ct. debenture 76¼, 76⅝, Tottenham "B" 101½, 101$\frac{13}{16}$. On Wednesday, Brighton and Hove 177, Continental Union 32, European 7⅞, Gas Light and Coke 93⅞, 94½, 4 p.ct. preference 79½, 3 p.ct. debenture 62½, Imperial Continental 145½ *ex* div., Primitiva 5 p.ct. preference 24s., South Metropolitan 97, 97½, 6½ p.ct. debenture 108, South Suburban 5 p.ct. 100¾, 101, 102, Tottenham "B" 101½. Supplementary prices, Liverpool 5 p.ct. 90½. On Thursday, Aldershot 4 p.ct. preference 71, Brentford "A" 103½, "B" 103, Commercial 3½ p.ct. 95, Continental Union 33, Croydon sliding-scale 103, Gas Light and Coke 93⅞, 94½, Imperial Continental 145½, Liverpool 7 p.ct. preference 106, Primitiva 6s., 4 p.ct. debenture (1911) 55, South Metropolitan 96½, Tottenham "A" 125, "B" 101, 101⅜. Supplementary prices, Eastbourne 5 p.ct. "A" 125, 125½, 3½ p.ct. "B" 108, 108½, Liverpool 5 p.ct. 90. On Friday, Brentford "B" 102½, Continental Union 32⅜, 33, Gas Light and Coke 93½, 93⅝, 94¼, 94⅜, 4 p.ct. preference 78, 78¼, Imperial Continental 144½, 145, Liverpool 7 p.ct. preference 106½, Primitiva 5 p.ct. preference 24s. 6d., 4 p.ct. debentures 74½, 4 p.ct. (Buenos Aires) debenture 57½, 58, (River Plate) debenture 57½, 58, South Metropolitan 96½, 97, 6½ p.ct. debenture 107, South Suburban 5 p.ct. 101. Supplementary prices, Liverpool 5 p.ct. 90½.

The dollar-sterling moved against this country as the week closed, dropping on Friday to $4·33\frac{5}{8}$. French francs showed a slight improvement at 80·80, and Belgian francs at 94·00.

In the Money Market business was on a small scale. Early in the week there was some degree of tightness, and borrowers paid up to 3½ p.ct. for fresh accommodation in order to avoid recourse to the bank, but on Friday advances were obtainable at as low a rate as 2 p.ct.

Owing to an Indian inquiry for immediate delivery, silver advanced to $33\frac{7}{16}$d. per oz.

The Bank rate is 4 p.ct., to which it was raised from 3 p.ct. on July 5. Bankers' deposit rates are 2 p.ct. The deposit rates of the discount houses are 2 p.ct. at call and 2¼ p.ct. at notice.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S TRANSACTIONS.

Issue.	Share.	When ex-Dividend.	Ante-War Dividend & Bonus.	Last Divid. at Rate of	NAME.	Closing Prices, July 30, 1914.	Variation. Quotation Nov. 30.	Variation. Lowest and Highest Prices of Transactions.
£			p.c.	% p.a.				
131,978	Stk.	Aug. 9	—	5	Aldershot 5 p.c. max. C.	..	72—77	...
217,992	,,	,,	4	4	Do. 4 p.c. Pref. .	..	70—75	71
1,551,868	,,	Oct. 4	2½	5½	Alliance & Dublin Ord.	59—64	67—72	67
374,000	,,	July 12	4	4	Do. 4 p.c. Deb.	76—79	62—67	...
280,000	5	Oct. 18	7½	8	Bombay, Ltd. . . .	5⅛—6⅜	5⅛—5⅜	...
100,000	10	Aug. 9	16	8½	Bournemouth Gas and Water { 5 p.c. . . / B 7 p.c. . / Pref. 6 p.c. / 4 p.c. Deb.	..	12½—13½	..
383,110	10	,,	7	7		15—15½	11⅝—12⅜	...
115,000	10	,,	6	6		13⅛—14	11—12	...
162,025	—	June 28	—	4		..	77—82	..
992,045	Stk.	July 12	14	6$\frac{7}{10}$	Brentford A Consolid. .	261—266	100—105	103¼—103⅜
734,920	,,	,,	11	6½	Do. B New . .	204—209	100—105	103¼—103⅜
55,000	,,	,,	5	5	Do. 5 p.c. Pref. .	109—111	99—95	...
221,400	,,	June 14	4	4	Do. 4 p.c. Deb. .	91—93	77—82	...
214,745	,,	Aug. 23	11	11½	Brighton & Hove Orig. .	208—213	175—180	177
244,200	,,	,,	8	8½	Do. A Ord. Stk.	154—159	127—132	...
1,287,500	Stk.	July 26	5	5	Bristol 5 p.c. max. . .	..	95—96*a*	...
570,000	20	Oct. 4	12½	12	British A Ord.	44—45	122—127	...
100,000	10	June 28	—	7	Do. 7 p.c. Pref. . .	..	122—127	...
120,000	Stk.	,,	4	4	Do. 4 p.c. Deb. Stk	88—90	75—80	...
100,000	10	May 17	—	7	Cape Town & Dis., Ltd'	1⅛—2⅛	7—8	...
100,000	10	Oct. 31	—	4½	Do. 4½ p.c. Pref. .	4—6	6—7	...
150,000	Stk.	June 28	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	75—80	...
237,860	,,	,,	—	7½	Cardiff 7½ p.c. Deb. . .	..	108—113	...
157,150	,,	Aug. 9	5	5	Chester 5 p.c. Ord. . .	108—110	85—90*b*	...
1,513,280	,,	July 26	5/9/4	6	Commercial 4 p.c. Stk.	106—108	95—98	...
560,000	,,	,,	5⅛	6	Do. 3½ p.c. do.	103—105	93—98	95
475,000	,,	June 14	3	3	Do. 5 p.c. Deb. Stk.	69⅛—71⅛	60—64	...
800,000	,,	14 Jan. 15	4	—	Continental Union, Ltd.	76—79	30—35	32—33
200,000	,,	Dec. 14	7	4	Do. 7 p.c. Pref.	115—118	90—95	..
660,000		Aug. 9	—	6½	Croydon sliding scale. .	..	102—105	103
284,975			—	5	Do. max. div. . . .	..	85—88	...
492,270	Stk.		6	4½	Derby Con. Stk. . .	123—125	107—110*c*	...
55,000	,,	—	4	4	Do. Deb. Stk. .	102—104	74—76*c*	...
209,000	,,	—	—	5	East Hull 5 p.c. max. .	..	..	...
1,002,180	10	July 12	10	5	European, Ltd. . . .	17½—18	7⅞—8⅛	7⅞
16,546,180	Stk.	July 26	4/17/4	5⅛	Gas { 4 p.c. Ord . . . / 3½ p.c. max. . .	98—102	93—95	93⅛—94⅛
2,600,000	,,	,,	3½	3½		76—79	65—68	...
4,062,235	,,	,,	4	4	Light { 4 p.c. Con. Pre. / and 3 p.c. Con. Deb.	96—99	78—81	78—79⅛
4,761,930	,,	June 14	3	3		72⅛—74⅛	61⅛—64⅛	62⅛
130,000	,,	Dec. 11	10	10	Coke 10 p.c. Bonds .	..	..	...
42,000	—	—	—	7⅛	7⅛ p.c. Ilford Deb.	..	..	...
82,500	,,	Sept. 19	5	6⅝	Hastings & St. L. 5 p.c.	..	93—98	...
258,740	,,	,,	3⅛	5⅛	Do. 3½ p.c.	87—89	78—83	...
70,000	10	Oct. 18	11	10	Hongkong & China, Ltd.	16⅛—16⅝	16—17	...
86,600	Stk.	Aug. 23	9	9⅛	Hornsey 7 p.c. . . .	..	144—149	...
1,976,000	,,	Nov. 15	9	5	Imperial Continental .	150—160	143—148	144⅛—146
401,400	,,	Aug. 9	3⅛	3⅛	Do. 3½ p.c. Deb. Red.	84—86	76—78	...
235,242	,,	,,	6⅛	6⅛	Lea Bridge Ord. 5 p.c.	119—121	95—100	
2,127,240	,,	Aug. 23	10	5⅛	Liverpool 5 p.c. Ord. . .	..	90—91*b*	90—91
600,000	,,	Sept. 19	—	7	,, 7 p.c. Pref. .	..	106—109*b*	106—106⅛
165,736	,,	Aug. 23	7/5/6	9	Maidstone 5 p.c. . .	..	125—130	...
63,480	,,	June 28	—	—	Do. 3 p.c. Deb . .	..	55—60	...
75,000	5	June 14	6	7	Malta & Mediterranean Met. of Melbourne { 4½ p.c. Deb.	4⅛—4⅜	3⅛—4	...
50,000	100	Oct. 1	4½	4½		99—101	95—98	...
341,920	Stk.	Nov. 29	4	4	Montevideo, Ltd. . .	11½—12	48—53*	...
1,875,892	,,	July 26	4½	4½	Newcastle & Gatsh'dCon.	98½—99½	85½—86½*d*	...
250,166	,,	Aug. 9	—	4	Do. 4 p.c. Pref. Stk.	..	74½—76½*d*	...
329,705	,,	June 28	3⅛	3⅛	Do. 3½ p.c. Deb.	82—83	73—74*d*	...
15,000	10	Aug. 23	—	11	North Middlesex 10 p.c.	..	16⅛—17⅛	...
75,940	10	,,	7/14/0	7$\frac{7}{10}$	,, ,, 7 p.c.	14—15	11⅛—12⅛	...
300,000	Stk.	Nov. 20	8	9	Oriental, Ltd. . . .	117—122	95—100*	...
138,120	Stk.	June 28	—	7½	Plym'th & Stonh'se 5 p.c.	..	108—113	...
60,000	50	Sept. 6	13	13	Portsea Island, B . .	128—131	105—110	...
100,000	50	,,	12	12	Do. C . . .	118—121	102—105	...
1,450,345	5	29 Oct. 14	8	—	Primitiva Ord. . . .	5⅛—6	⅛—⅛	6/-
2,499,800	5	30 Dec. 15	5	—	Do. 5 p.c. Pref. .	4⅛—5	$1\frac{1}{16}$—$1\frac{7}{16}$	24/—24/6
341,400	100	June 1	4	4	Do. 4 p.c. Deb. .	91—93	71—75	74⅛
600,000	Stk.	July 26	4	4	Do. ,, ,, 1911	..	55—58	55
220,335	,,	June 28	4	4	Do. B. Aires 4 p.c. Deb.	85—87	56—59	57⅛—58
321,670	,,	,,	4	4	Do. Riv. Pl. 4 p.c. Deb.	85—87	56—59	57⅛—58
150,000	10	Oct. 4	6	6	San Paulo { 6 p.c. Pref. / 5 p.c. Deb.	10⅛—11	5⅛—6	...
125,000	50	July 2	5	5		47—49	38—41	...
270,000	Stk.	Aug. 23	10	5	Sheffield A	223—224	100—102*e*	...
419,968	,,	,,	10	5	Do. B	222—224	100—102*e*	...
1,047,000	,,	,,	10	5	Do. C	220—222	100—102*e*	...
133,201	Stk.	—	4	6	Shrewsbury 5 p.c. . .	..	..	..
90,000	10	Oct. 18	9	6	South African . . .	10⅛—11⅛	7—9	..
1,609,895	Stk.	July 26	5/9/4	5	South Met. Ord. . . .	111—113	96⅛—98½	96⅛—97⅛
250,000	,,	July 12	—	5	Do. Red. Pref. .	..	98—100	...
1,895,445	,,	,,	3	3	Do. 3 p.c. Deb. .	72⅛—74⅛	61—64	...
734,000	,,	Sept. 6	—	6½	Do. 6½ p.c. Deb.	..	106—108	107—108
91,500	,,	Aug. 23	8½	8½	South Shields Con. Stk.	157—159	134—136*d*	..
1,087,795	,,	,,	6	6	S'th Suburb'n Ord. 5 p.c.	114—116	100—103	100¾—102
368,837	,,	June 28	5	5	Do. 5 p.c. Deb. Stk.	116—118	97—102	...
647,740	,,	Nov. 15	5	5	S'th'mpt'n Ord. 5p.c. max	99—102	86—89	...
121,275	,,	June 28	4	4	Do. 4 p.c. Deb. Stk.	..	76—81	76⅛—76⅝
250,000	,,	Aug. 23	—	7	Swansea 7 p.c. Pref. Stk.	..	102—104	...
200,000	,,	June 28	—	6½	Do. 6½ p.c. Deb. Stk.	..	105—107	...
120,000	,,	July 26	—	8	Tottenham { A 3 p.c. / B 3½ p.c. / 4 p.c. Deb	135—138	122—127	125
782,275	,,	,,	6	6½		115—117	100—105	101⅛—101$\frac{13}{16}$
181,255	,,	June 14	4	4	District	87—89	78—82	...
858,251	Stk.	Aug. 23	5	5	Tynemouth 5 p.c. max.	108½—109	89—91*d*	...
					Wandsworth, Wimbledon, and Epsom—			
30,000	,	July 12	8½	9	Wandsworth A 5 p.c. .	151—156	140—145	...
255,636	,,	,,	6½	7½	Do. B 3½ p.c. .	129—134	116—121	...
108,075	,,	,,	5/17/3	6$\frac{5}{16}$	Do. C. . . .	110—115	100—105	...
140,865	,,	,,	—	6$\frac{5}{16}$	New Ordinary . . .	..	..	...
352,000	,,	,,	6½	7½	Wimbledon 5 p.c. . .	117—122	110—115	...
98,000	,,	,,	6½	7½	Epsom 5 p.c. . .	121—126	118—123	...
88,416	,,	June 28	3	3	3 p.c Deb. Stk. . .	66—69	57—60	...

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